Hearings Examiner Meeting Agenda
Tuesday, November 10, 2026, 4:00 PM
Council Chambers, 616 NE 4th AVE

NOTE: The City welcomes public meeting citizen participation. TTY Relay Service: 711. In compliance with the ADA, if you need special assistance to participate in a meeting, contact the City Clerk's office at (360) 834-6864, 72 hours prior to the meeting so reasonable accommodations can be made (28 CFR 35.102-35.104 ADA Title 1)

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OPTION 1 -

1. Go to www.zoom.us and download the app or click "Join A Meeting" and use Meeting ID – 895 4587 8122
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For Public Comment:
Click the raise hand icon in the app or by phone, hit *9 to "raise your hand", or email to communitydevelopment@cityofcamas.us

These will be entered into the meeting record. Emails received up until one hour before the start of the meeting will be emailed to the Meeting Body prior to the meeting start time.

CALL TO ORDER

INTRODUCTIONS AND INSTRUCTIONS

HEARING ITEM

1. Parklands II Short Plat (File No. SP26-1005)
   Presenter: Lauren Hollenbeck, Senior Planner

CLOSE OF MEETING

LAND USE DECISION

Parklands II

Preliminary Narrative

Jurisdiction:

City of Camas, Washington

Applicant & Owner:

MAS1A, LLC
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SGA Project #2451
July 7, 2026

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1 PROJECT OVERVIEW

1.1 CLIENT INFORMATION

MAS1A, LLC – ATTN: Jon Ellsworth
3405 NW McMaster Drive
Camas, WA 98607
(360) 798 - 2400
jonellsworthre@gmail.com

1.2 PROPERTY INFORMATION

PARCEL NUMBER – 986043913 & 986043914
SITUS ADDRESS – 3711 & 3815 NW Camas Meadows Drive, Camas, WA 98607
PROJECT SIZE (sf / ac) – 141,521 sf / 3.25 ac
ZONING – Business Park (BP) & R-15
PARCEL OWNER – MAS1A, LLC – ATTN: Jon Ellsworth

2 SITE CONDITIONS AND CONTEXT

The subject site consists of two parcels addressed as 3711 and 3815 NW Camas Meadows Drive, Camas, Washington, totaling approximately 3.09 acres proposed for subdivision into 8 single-family detached residential lots and a pocket park. The site is zoned Single-Family Residential (R-15) and Business Park (BP) and is subject to the Mixed Use Planned Development (MXPD) Overlay, governed by Development Agreement recording number 6248594 AMD and its associated Master Plan. The site is located on the north side of NW Camas Meadows Drive, which is classified as a fully improved Arterial per the 2016 Comprehensive Plan Map.

2.1 Topography & Drainage

According to the geotechnical site investigation prepared by Columbia West Engineering, Inc. (June 23, 2015), elevations within the Parklands master plan area range from roughly 190 feet along the northern boundary to about 240 feet in the southern portion, with the subject parcels near NW Camas Meadows Drive exhibiting generally flat to gently sloping terrain. The report identifies typical slopes of 5–10 percent, with isolated areas approaching 20 percent farther south in the master plan area; slopes within the 3.09-acre short plat are expected to fall at the lower end of this range due to the site's proximity to the roadway corridor. Surface drainage is influenced by an existing network of stormwater conveyance infrastructure, including a 24-inch perforated dispersion pipe along the north property line and multiple 15-inch and 18-inch storm pipes that cross the development area, conveying flows from NW Camas Meadows Drive, adjacent developments, and upstream portions of Parklands. City Engineering staff have identified resolution of these facilities—through rerouting, easement modification, or site plan adjustments—as a prerequisite to preliminary short plat approval, and a preliminary stormwater report consistent with *CMC 14.02* and the 2024 SWMMWW will be required with the application.inary GIS elevation data indicates that the site ranges from approximately 190 to 230 feet in elevation, with slopes generally between 5–15%, and localized areas exceeding 15% along the northern and eastern portions of the property. Detailed slope

gradients, drainage patterns, and subsurface conditions will be updated upon review of the formal geotechnical investigation.

2.2 Soils & Geology

Subsurface conditions at the subject site are described in the geotechnical site investigation prepared by Columbia West Engineering, Inc. (Project No. 15153, June 23, 2015). Although the investigation covered the full 36.4-acre Parklands at Camas Meadows master plan area, the findings are applicable to the subject parcels located near Test Pit TP-8 along the northwestern margin of the site. The report identifies three primary soil types: an upper layer of 10 to 18 inches of topsoil and organic material overlying fine-textured silt and clay soils (Soil Type 1 — sandy SILT to sandy FAT CLAY, USCS ML and CH) with moderate to high plasticity; weathered conglomerate residuum (Soil Type 2 — clayey SAND to poorly graded GRAVEL with silt and sand); and competent conglomerate bedrock (Soil Type 3) encountered at depths of 3 to 16.5 feet. The geotechnical engineer notes that sandy FAT CLAY soils may be unsuitable for road subgrade or foundation support without remediation.

Groundwater was observed at 2.5 feet below ground surface in Test Pit TP-1, located in the northern portion of the master plan area closest to the subject parcels. Shallow groundwater may affect utility trenching, subgrade preparation, and wet-weather construction, and the report notes that groundwater levels may fluctuate seasonally with potential for perched conditions. Allowable bearing capacities are estimated at 1,500 psf for foundations bearing on Soil Type 1 and 2,000 psf for foundations bearing on Soil Types 2 and 3, with a recommended 12-inch crushed aggregate base compacted to 95 percent of modified Proctor density. Import structural fill meeting WSDOT gradation requirements may be required if native fine-textured soils cannot achieve compaction or if construction occurs during wet conditions. The site is assigned Seismic Site Class C per the WSDNR (2004) map, with a peak ground acceleration of 0.38g at 2 percent probability of exceedance in 50 years, and liquefaction susceptibility is rated very low.

2.3 Critical Areas

The subject site is located within the City of Camas and is subject to critical areas review under *CMC Title 16*. Based on City GIS mapping and the June 2025 pre-application meeting notes (PA25-1057), no wetlands, streams, or other mapped critical areas are located within the 3.09-acre short plat area; however, a wetland and associated buffer occur north of the broader Parklands master plan site, and a regional pedestrian trail lies within that buffer. The subject parcels do not contain mapped steep slopes, with both GIS data and the geotechnical investigation indicating typical gradients of 5–10 percent and no landslide hazard indicators. The site is mapped within a Critical Aquifer Recharge Area (CARA), but no additional critical areas are identified. A Determination of Non-Significance (SEPA15-14) was issued for the Parklands at Camas Meadows Master Plan in 2016, and the archaeological predetermination completed for the master plan (DA15-03) remains applicable.

2.4 Vegetation & Trees

The site is primarily covered with second-growth vegetation typical of previously platted but undeveloped land. A mix of coniferous and deciduous trees is present, with canopy concentrated along the northern and eastern edges occurring all offsite.

2.5 Existing Structures and Utilities

There are no existing buildings on the subject parcels. The site is served by adjacent urban utilities, including water, sewer, stormwater, power, natural gas, and telecommunications**,** with multiple stubs already extended to the property from prior phases of the Parklands development. Existing stormwater conveyance easements and pipes traverse the site, as documented in the City's pre-application notes; these will be addressed through the plat alteration and engineering design process.

2.6 Surrounding Land Use and Zoning

The surrounding area includes a mix of residential, commercial, and recreational uses consistent with the Parklands and Camas Meadows corridor. To the west and north lies the Camas Meadows Golf Course. To the east and south are existing single-family neighborhoods within the Parklands subdivision. Zoning in the immediate vicinity includes BP**,** R-15**,** R-10**,** R-7.5, and MF-18, reflecting the transitional nature of this area between residential and employment districts.

3 PROPOSED DEVELOPMENT DETAILS

This section describes the physical layout of the proposed development, including the lot configuration, access, street design, utilities, easements, and open-space elements. The intent is to provide a clear overview of how the site is organized and how existing conditions, recorded easements, and the Development Agreement shaped the design. This section is descriptive only; detailed compliance with applicable standards is addressed in Section 4.

3.1 Lot Layout

The proposed short plat will create eight single-family detached residential lots and one pocket park on approximately 3.25 acres. The lot configuration is shaped heavily by existing site constraints, including the location of the gated entrance on NW Pittock Place at the western boundary and a 100-foot-wide PacifiCorp transmission corridor easement that encumbers the entire eastern edge of the property. To align with the established neighborhood circulation pattern, the new private street extends east from NW Pittock Place, directly behind the existing gate, providing a logical continuation of access into the site.

Lots 1 through 5 are arranged along the south side of the new private street and function as double-frontage lots, with their rear yards oriented toward NW Camas Meadows Drive. Lots 6 through 8 are located north of the east–west private street, forming a compact cluster buffered from the arterial frontage. The large PacifiCorp easement along the eastern property line significantly influenced the overall layout, as it restricts building activity and limits the placement of permanent structures. This constraint created an opportunity to locate the required 15,000-square-foot contiguous pocket park within the

easement area, where recreational use is compatible with PacifiCorp's rights and long-term access needs.

Within the PacifiCorp easement is an existing temporary turnaround constructed during prior development to the east. Although originally intended as a construction feature, it has functioned as the preferred turnaround for vehicles approaching the gated access on NW McMaster Drive. To preserve this operational pattern and avoid disrupting the established circulation, the proposed private street terminates in a cul-de-sac design west of the easement, allowing the existing turnaround to remain in place. This approach maintains continuity with the surrounding street network while respecting the physical and operational constraints imposed by the easement and adjacent development.

3.2 Access and Circulation

Access to the development is provided exclusively from NW Pittock Place, an existing private street that currently serves Lots 1–5 of the Parklands subdivision and terminates at a gated entry at the western edge of the site. The new private street extends east from this point behind the existing gate, continuing the established circulation pattern and serving all eight proposed lots. It terminates in a new cul-de-sac located near the center of the site, positioned approximately ten feet west of the existing temporary turnaround within the 100-foot-wide PacifiCorp transmission corridor. This placement preserves the longstanding maneuvering area used by vehicles approaching the gated access on NW McMaster Drive while providing a dedicated turnaround for the new private street.

Circulation within the development is straightforward, with all lots taking direct access from the new private street and pedestrian connections provided along the frontage, including links to the pocket park and the existing trail system to the north. As part of the project's frontage improvements, the existing commercial driveway drop along NW Camas Meadows Drive will be removed and replaced with standard curb, planter strip, and sidewalk to match the established streetscape on either side, restoring a continuous pedestrian environment and reinforcing the residential character of the corridor.

3.3 Private Street and Cul-de-sac Design

The development is served by a new private street extending east from NW Pittock Place, aligned directly behind the existing gate to maintain the established entrance configuration. The street continues east toward the PacifiCorp transmission corridor, where it terminates in a cul-de-sac located approximately ten feet west of the existing temporary turnaround within the easement. A small portion of the new turnaround extends into the easement to accommodate maneuvering needs while preserving the existing turnaround's function for vehicles approaching the gated access on NW McMaster Drive. The street and cul-de-sac are designed to provide straightforward access to all lots while fitting within the site's physical constraints and the required open-space layout.

3.4 Utilities

Public utilities are available adjacent to the site and will be extended to serve the eight proposed lots and the pocket park. Water and sanitary sewer services will connect to existing mains within NW Pittock Place, where stubs and capacity were planned as part of earlier phases of the Parklands development. Stormwater from the new private street and individual lots will be routed through the existing storm conveyance system that

crosses the site, with final design to be addressed through the engineering review and plat alteration process.
Power, natural gas, and telecommunications will be extended from existing facilities located along NW Pittock Place and NW Camas Meadows Drive. The 100-foot-wide PacifiCorp transmission corridor along the eastern property line will remain in place and unobstructed, with all utility extensions and service connections designed to avoid conflicts with PacifiCorp infrastructure and access needs. Utility routing will be coordinated to maintain clearances, preserve easement rights, and ensure reliable service to all lots.

3.5 Pocket Park

The development includes a publicly accessible pocket park located along the eastern edge of the site, outside the privately gated portion of the community. This park fulfills the open-space requirement established in the Development Agreement and provides a neighborhood-serving amenity that remains open to the public.
The park is sited within the recorded 100-foot-wide PacifiCorp transmission corridor easement, which contains no active transmission facilities but restricts permanent structures. These constraints made the easement area the most suitable location for the required contiguous open-space area. The park will include open turf, a defined play area, shade trees, seating, and pedestrian connections, creating a functional public amenity while preserving PacifiCorp's long-term rights within the corridor.

3.6 HOA and Maintenance

The proposed lots will be incorporated into the existing Parklands HOA, which will assume responsibility for maintaining the private street, gate, landscaping within the right-of-way, and other shared improvements. The pocket park, located outside the gated portion of the community and open to the public, will be maintained in accordance with the requirements of the Development Agreement, ensuring long-term upkeep of the open-space amenity. All utility easements, access easements, and shared facilities will be managed through the HOA or dedicated to the appropriate service providers as part of the final plat.

4 CODE COMPLIANCE AND STANDARDS

This section demonstrates how the proposed short plat complies with the applicable provisions of the Camas Municipal Code, the Mixed-Use Planned Development (MXPD) zoning framework, and the requirements of the Development Agreement governing the Parklands project. Each subsection summarizes the relevant standards and provides a clear statement of how the proposed layout, access, utilities, open space, and easements meet those requirements. The intent is to provide a straightforward, code-based compliance review that complements the descriptive site design information presented in Section 3.

4.1 Lot Standard

The proposed short plat meets all applicable lot dimensional standards established in the Parklands Development Agreement. The DA requires a minimum lot size of 8,000 square feet and a minimum lot width of 80 feet. All eight lots exceed these thresholds: the

smallest lot is approximately 10,417 square feet, the largest is approximately 16,475 square feet, and each lot provides at least 80 feet of frontage along the new private street. The site contains 3.25 acres of gross area, with 0.54 acres dedicated to the private street right-of-way, resulting in a net site area of 2.71 acres. Within this net area, two open-space tracts are provided: Tract A, the publicly accessible pocket park, at 17,983 square feet, and Tract B at 4,818 square feet. The remaining land area is allocated to the eight residential lots, all of which exceed the DA's minimum dimensional requirements.

The DA also establishes modified setbacks for this neighborhood, including a 15-foot front setback to the primary building façade, a 20-foot setback to any garage, a 10-foot street-side setback, a 5-foot interior side setback, and a 5-foot rear setback, with 10 feet required for double-fronting rear yards unless enhanced landscaping or sight-obscuring fencing is provided. All proposed lots are sized and shaped to accommodate these setbacks without requiring any deviations. Lots 5 and 6 include recorded building-restriction easements to ensure that future structures remain outside the PacifiCorp transmission corridor, preserving compliant buildable envelopes.

Based on the DA standards and the proposed lot dimensions, the plat complies with the applicable provisions of *CMC 18.24* and *CMC 18.09*, and no variances or modifications are requested.

4.2 Access & Circulation

The proposed access and circulation system complies with the applicable provisions of *CMC 17.19.040, 17.19.050, 17.19.060*, and the private street standards of *CMC 17.21.030*. All lots take direct access from a new private street that extends approximately 411 feet from the existing gated entry to a full cul-de-sac. The private street is contained within a 48-foot-wide tract and includes a 28-foot asphalt driving surface with 5-foot detached sidewalks on both sides, meeting the City's dimensional requirements for private residential streets serving multiple single-family lots within the MXPD.

The cul-de-sac meets the turnaround requirements of *CMC 17.19.060*, with a 45-foot radius tract dedication and a 35-foot radius paved surface. The detached sidewalk continues around the full perimeter of the bulb, providing continuous pedestrian circulation and satisfying the City's pedestrian connectivity standards. The turnaround geometry provides adequate clearance for emergency vehicle maneuvering consistent with *CMC 17.21.040*.

The existing gate at the entrance to the private street remains in its current configuration and does not require modification as part of this plat. All eight lots are served by individual driveways, each planned at a typical width of 30 feet, and no shared driveways are proposed. The resulting layout provides compliant vehicular access, emergency access, and pedestrian circulation throughout the site without the need for any deviations or modifications.

4.3 Utilities

Utility service for the proposed short plat is designed to comply with the applicable provisions of *CMC 17.19.040* and the requirements outlined in the City's Pre-Application Conference Notes for PA25-1057. Two existing 8-inch ductile iron water mains are stubbed to the site—one from NW Pittock Place and one from NW McMaster Drive—and will be extended to form a continuous 8-inch water main serving all eight lots, consistent

with *CMC 17.19.040.C.4.a*. Each lot will be provided with an individual 1-inch water service and meter box, and irrigation for the open-space tracts will be served by a separate irrigation meter as required. The City may require installation of additional fire hydrants during engineering review, and all trenching and restoration within NW Camas Meadows Drive or NW Pittock Place will follow CDSM Details G2 and G2A.

Sanitary sewer service will utilize the two existing 2-inch PVC pressure sewer laterals stubbed into the site from NW Camas Meadows Drive. Sewer extensions and laterals will be installed to serve each lot, maintaining the required 10-foot horizontal separation from the water main within the private street tract, consistent with City standards. All trenching and restoration in the adjacent right-of-way will follow CDSM Details G2 and G2A.

Stormwater management will be designed in accordance with *CMC 14.02* and the 2024 Stormwater Management Manual for Western Washington. Because the project will create more than 5,000 square feet of new and replaced hard surface area, all Minimum Requirements 1 through 9 will apply. The site contains multiple existing stormwater conveyance systems and manholes that serve upstream developments, including a 24-inch perforated dispersion system and several 10- to 18-inch storm mains within recorded easements. These systems will be preserved in place, and the preliminary plat identifies the required stormwater easements to ensure continued access and function. Any necessary rerouting or protection measures will be addressed during engineering review. Stormwater facilities will be located in a tract and maintained by the HOA, with City right-of-entry for inspection.

The proposed utility layout meets the applicable requirements of the Camas Municipal Code and the Pre-Application Conference Notes, and no deviations from utility standards are requested as part of this preliminary short plat.

4.4 Open Space/Pocket Park

Section 4.3 of the Development Agreement establishes the standards for the required pocket park, including a minimum 15,000 square feet of contiguous area; a 3,000-square-foot play area with equipment appropriate for toddlers and elementary-aged children; at least one picnic table and two benches; landscaping that includes open turf and shade trees; and an 8-foot-wide asphalt or concrete trail providing access to the edge of Wetland Tract A. The park must remain publicly accessible, be owned and maintained by an HOA, and include assurance of completion prior to final plat recording.

The proposed pocket park is located within Tract A, which contains 17,983 square feet, exceeding the minimum contiguous area required under Section 4.3. The design includes a 3,123-square-foot playground with equipment suitable for children ages 0–12, meeting the required play area size and age range. The park program provides one picnic table, two benches, an open turf area, and shade trees, satisfying all required amenity and landscaping elements. Public access is provided through a pedestrian gate at the private cul-de-sac, and an 8-foot-wide trail connection extends from the park to the existing trail easement along the east property boundary. This trail continues north to connect with the regional trail system, maintaining the required public connection. Tract A will be owned and maintained by the HOA and will remain publicly accessible, consistent with Section 4.3 of the Development Agreement.

4.5 Easements

The preliminary short plat identifies all existing easements affecting the property, including multiple stormwater conveyance easements, utility easements, access easements, and the PacifiCorp transmission corridor easement along the eastern boundary. The stormwater easements contain several existing conveyance systems and manholes that serve upstream developments, including 24-inch, 18-inch, 15-inch, and 10-inch storm mains. These easements are preserved in place, and the plat maintains the required access and protection for these facilities.

Lots 5 and 6 include building-restriction easements associated with the PacifiCorp transmission corridor. These easements are shown on the plat and have been incorporated into the lot layout to ensure compliant building envelopes remain available on each lot.

A new easement is created around the existing paved turnaround located east of the site on NW McMaster Drive. This easement ensures continued access and maneuvering space for vehicles approaching the gated entry serving the existing Parklands subdivision. The new cul-de-sac is positioned to maintain this function while providing a dedicated turnaround for the proposed private street.

Any existing easements proposed for removal or modification will be processed through a separate plat alteration application, consistent with *CMC 18.55.270.E*. All required easements for utilities, stormwater, pedestrian access, and trail connections are shown on the preliminary plat, and no conflicts occur with required setbacks or buildable areas.

4.6 Transportation and Traffic Compliance

A technical traffic memorandum prepared by Charbonneau Engineering (March 30, 2026) confirms that the eight-lot short plat will generate 73 daily trips, 6 AM peak-hour trips, and 7 PM peak-hour trips—well below thresholds for a Transportation Impact Analysis or traffic-calming measures. Intersection sight distance at the gated access on NW Pittock Place is adequate, with all entering vehicles slowing or stopping at the gate and clear visibility available for drivers exiting the site. WSDOT crash data show no reported collisions at the NW Camas Meadows Drive / NW Payne Street / NW Pittock Place roundabout from 2020–2024, and no mitigation is recommended. Trip distribution and assignment follow the City's pre-application direction, with only one Vancouver proportionate-share intersection—the SE 192nd Avenue / SR-14 ramp terminals—receiving project traffic, resulting in a $6,000 fee for three PM peak-hour trips. The traffic engineer identifies no operational impacts or movement conflicts and recommends approval without transportation system improvements, satisfying the transportation-related requirements of *CMC 17.19.040*, *CMC 18.17.030*, and the PA25-1057 pre-application notes.

4.7 Preliminary Short Plat Approval Criteria

The proposed short plat satisfies the criteria for preliminary approval outlined in *CMC 17.09.030*. The project is consistent with the Camas Comprehensive Plan, the Parklands Master Plan, and all adopted City plans applicable to the MXPD, meeting the conformance requirement of *CMC 17.09.030.D(1).* Provisions for water, storm drainage, erosion control, and sanitary sewage disposal comply with current standards in the

Camas Design Standards Manual, satisfying *CMC 17.09.030.D(2)*, with water and sewer extended from existing mains and stormwater routed through preserved conveyance systems within recorded easements. The private street, sidewalks, utilities, street lighting, and street trees are designed consistent with the six-year street plan and the Camas Design Standards Manual, addressing *CMC 17.09.030.D(3)*. All required dedications, easements, and reservations—including stormwater easements, access easements, and the PacifiCorp transmission corridor—are provided on the preliminary plat in accordance with *CMC 17.09.030.D(4)*. Transportation impacts have been evaluated through the Charbonneau Engineering memorandum, which identifies no operational deficiencies and assigns the required proportionate-share fee, fulfilling *CMC 17.09.030.D(5)*. The lot design, shape, and orientation support the intended single-family residential use and comply with the dimensional standards of the Development Agreement, meeting *CMC 17.09.030.D(6)*. Long-term maintenance of the private street, open space, and shared facilities is provided through the Parklands HOA, consistent with *CMC 17.09.030.D(7)*. The plat complies with all relevant provisions of the Camas land development and zoning codes, including Titles 14, 16, 17, and 18, satisfying *CMC 17.09.030.D(8)*. Finally, the proposal meets the requirements of *Chapter 58.17 RCW* and all applicable state and local laws in effect at the time of preliminary plat approval, addressing *CMC 17.09.030.D(9)*.

5 CONCLUSION/SUMMARY

The Parklands II Short Plat proposes eight single-family detached lots and a publicly accessible pocket park consistent with the Parklands Development Agreement and the MXPD overlay. The lot layout, private street, pedestrian connections, and open-space design all conform to the dimensional, access, and open-space standards established in the DA and applicable provisions of *CMC Titles 14, 16, 17,* and *18*. Existing stormwater and utility easements are preserved, and all lots meet or exceed the required buildable area and setback standards without the need for variances.

The accompanying traffic analysis confirms that the project generates low trip volumes, maintains adequate sight distance, has no crash-related safety concerns, and results in only one proportionate-share impact. With compliant access, utilities, stormwater management, and open-space improvements, the proposal meets the applicable approval criteria for a preliminary short plat and is suitable for approval.

For questions or additional project information, please contact SGA Engineering, PLLC at (360) 993-0911 or email Scott Taylor (staylor@sgaengineering.com) and Nate Horvath (nhorvath@sgaengineering.com).

PARKLANDS II SHORT PLAT

DEVIATION TO ENGINEERING STANDARDS NARRATIVE

Request for:

- Relief from Camas Design Standards Manual (CDSM) Table 3 – Access Spacing Standards, intersections accessing an Arterial must maintain a minimum spacing of 300 feet. The proposed private road will take access from the existing NW Pittock Place and will remain fully behind the private gate. The proposed alignment is approximately offset 180 feet, which will not meet the requirement of CDSM Table 3.

This request meets the following justification criteria:
City code listed below with applicant responses in ***Bold Italics.***

14.02.110 - Deviations.

The approval authority may authorize deviations from the minimum requirements of this chapter pursuant to a Type II decision or as part of a consolidated review process . Any decision to approve a deviation shall include affirmative findings addressing the following:
This is part of a type II short plat review process.

A.The deviation provides for the use of low impact development practices for stormwater management; or
This deviation request will limit the amount of access points needed to access this short plat.

B.The deviation shall be limited and shall provide equivalent environmental protection.
The deviation reduces pollution generating road surfaces which provides increased environmental protection.

1.The deviation shall be based on sound engineering practices, with the objectives of safety, function, environmental protection, and facility maintenance considered.
This deviation request supports all of the criteria by utilizing the existing gated entrance on NW Pittock Place.

2.The deviation requested does not necessitate the need for additional deviations, exceptions, or variances from the Camas Municipal Code.
These deviations are the minimum necessary to provide this development with the same safe environment and high functioning neighborhood design as the adjacent subdivisions. No additional deviations, exceptions or variances are being requested. The proposed private road alignment is in the ideal location that works with the existing conditions of the private gate and the neighboring lots. The proposed alignment is approximately 180 feet from Camas Meadows Drive and is behind an existing private gate and road.

Any authorization for deviation may prescribe conditions deemed necessary or desirable for the public interest. (Ord. No. 16-019 , § I(Exh. A), 11-21-2016)
Conditions of approval may be warranted for the reduced intersection spacing along NW Pittock Place. Sight distance has been verified by the traffic engineer. Additional safety signage may be required by city staff.

Thank you for your consideration of this request. Please contact Scott Taylor or Joe Intermill of SGA Engineering with any questions or concerns at 360-993-0911.

Sincerely,

Joe A. Intermill, P.E.



04/02/2026

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Community Development Department | Planning
616 NE Fourth Avenue | Camas, WA 98607
(360) 817-1568
communitydevelopment@cityofcamas.us

General Application Form **Case Number:**

Applicant Information

Applicant/Contact:: **Applicant: MAS1, LLC C/O Jon Ellsworth**
Contact: Scott Taylor (SGA Engineering)

Phone: 360.798.2400 / 360.993.0911

Address: 3405 NW McMaster Drive / 2005 Broadway
Street Address

E-mail Address: jonellsworthre@gmail.com / staylor@sgaengineering.com

Camas WA 98607
Vancouver WA 98663
City *State* *ZIP Code*

Property Information

Property Address: 3711 and 3815 NW Camas Meadows Drive
Street Address

County Assessor # / Parcel #: 986043914 & 986043913

Camas WA 98607
City *State* *ZIP Code*

Zoning District: Business Park (BP) & R-15 Site Size: 3.25 acres

Description of Project

Brief description: To subdivide approximately 3.25 acres into 8 single-family detached lots and a pocket park.
Plat alteration to remove and relocate some storm and path easements.

Are you requesting a consolidated review per CMC 18.55.020(B)? YES ☒ NO ☐

Permits Requested: ☐ Type I ☐ Type II ☒ Type III ☐ Type IV, BOA, Other

Property Owner or Contract Purchaser

Owner's Name: MAS1, LLC C/O Jon Ellsworth
Last *First*

Phone: (360) 798.2400

3405 NW McMaster Drive / N/A
Street Address *Apartment/Unit #*

E mail Address: Camas WA 98607
City *State* *Zip*

jonellsworthre@gmail.com

Signature

I authorize the applicant to make this application. Further, I grant permission for city staff to conduct site inspections of the property.

Signature: [signature] **Date:** 3/19/2026

Note: If multiple property owners are party to the application, an additional application form must be signed by each owner. If it is impractical to obtain a property owner signature, then a letter of authorization from the owner is required.

Date Submitted: Pre-Application Date:	
Staff: Related Cases # ☐ **Electronic Copy Submitted**	**Validation of Fees**

RCW 58.17.215

Alteration of subdivision—Procedure.

When any person is interested in the alteration of any subdivision or the altering of any portion thereof, except as provided in RCW 58.17.040(6), that person shall submit an application to request the alteration to the legislative authority of the city, town, or county where the subdivision is located. The application shall contain the signatures of the majority of those persons having an ownership interest of lots, tracts, parcels, sites, or divisions in the subject subdivision or portion to be altered. If the subdivision is subject to restrictive covenants which were filed at the time of the approval of the subdivision, and the application for alteration would result in the violation of a covenant, the application shall contain an agreement signed by all parties subject to the covenants providing that the parties agree to terminate or alter the relevant covenants to accomplish the purpose of the alteration of the subdivision or portion thereof.

Upon receipt of an application for alteration, the legislative body shall provide notice of the application to all owners of property within the subdivision, and as provided for in RCW 58.17.080 and 58.17.090. The notice shall either establish a date for a public hearing or provide that a hearing may be requested by a person receiving notice within fourteen days of receipt of the notice.

The legislative body shall determine the public use and interest in the proposed alteration and may deny or approve the application for alteration. If any land within the alteration is part of an assessment district, any outstanding assessments shall be equitably divided and levied against the remaining lots, parcels, or tracts, or be levied equitably on the lots resulting from the alteration. If any land within the alteration contains a dedication to the general use of persons residing within the subdivision, such land may be altered and divided equitably between the adjacent properties.

After approval of the alteration, the legislative body shall order the applicant to produce a revised drawing of the approved alteration of the final plat or short plat, which after signature of the legislative authority, shall be filed with the county auditor to become the lawful plat of the property.

This section shall not be construed as applying to the alteration or replatting of any plat of state-granted tide or shore lands [tidelands or shorelands].

[1987 c 354 s 4.]

PRE-APPLICATION MEETING NOTES
Parklands II short plat
PA25-1057

Thursday, June 6th, 2025
1:30pm, City Hall (virtual meeting)
616 NE 4th Ave. Camas, WA. 98607

Applicant:	Jon Ellsworth
City of Camas attendees:	Lauren Hollenbeck, Senior Planner Robert Maul, Planning Manager Alan Peters, Community Development Director Eric Dugger, Engineer II Anita Ashton, Engineering Project Manager Randy Miller, Deputy Fire Marshal Brian Smith, Building Official
Location:	3711 and 3815 NW Camas Meadows Drive Camas, WA 98607
Zoning:	Business Park (BP) Single-Family Residential (R-15)
Description:	To subdivide approximately 3.09-acres into 8 single-family detached residential lots and a pocket park.

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 "City Codes".

PLANNING DIVISION **LAUREN HOLLENBECK (360) 817-7253**

With a Mixed Use Plan Development (MXPD) Overlay zone, development of this property is subject to an approved Development Agreement (DA) and Master Plan (recording number 6248594 AMD) including any applicable codes for this proposal such as Title 16 Environment, Title 17 Land Development and Title 18 Zoning of the Camas Municipal Code (CMC). Please note it remains the **applicant's responsibility** to review the DA and Master Plan including the CMC and address all applicable provisions. The following pre-application notes are based on application materials and site plan submitted to the City on May 5, 2025:

PLEASE NOTE: Land use applications are now required to be submitted and paid on-line at www.cityofcamas.us/com-dev. If you need assistance, contact the Planning Department.

Application Requirements

Your proposal will need to comply with the general application requirements per **CMC Section 18.55.110** in addition to the specific applicable application requirements outlined in **CMC Section 17.09.030.B** for a preliminary short plat. An application for a short plat is considered a Type II permit. The following is an excerpt from the requirements of CMC Section 17.09.030.B (see code section for full text):

1. A completed city application form and required fee(s), which are addressed at on-line submittal;

Fees will be based on the adopted fees at the time of land use application submittal. The current fees include the following:	
1. Plat Alteration	$1,519.00
2. Preliminary Short Plat	$9,115.00 + 290.00 per lot
3. Fire Department Review	$358.00
Fees for building permit are collected at the time of the building permit submittal. Fees for engineering are collected at time of engineering plan approval.	
4. Building Permit and Plan Review	based on the valuation of the project
5. Engineering Review	3% of estimated construction costs

2. Complete applications for other required land use proposals applicable to the proposal;
3. A vicinity map showing location of the site; and
4. Site and development plans which provide the following information outlined in CMC Section 17.09.030.B.5 (a-q):
5. Preliminary grading plan;
6. Preliminary stormwater plan and report;
7. Preliminary geotechnical report;
8. A narrative addressing ownership and maintenance of open spaces, stormwater facilities, public trails and critical areas, and the applicable approval criteria (CMC Section 17.09.030.D) and the standards of the Camas Municipal Code.
9. A development sign must be posted on site per CMC Section 18.55.110.H (1-5).
10. Necessary drawings and reports- three full size paper copies of the site plan drawings. All other documents and reports shall be provided with the on-line application submittal;
11. A current (within thirty days prior to application) mailing list and mailing labels of owners of real property within three hundred feet of the subject parcel, certified as based on the records of the Clark County assessor;

Plat Alteration

Any existing easements proposed to be extinguished or rerouted with the project proposal will require a plat alteration per CMC 18.55.270.E, which is a modification to an approved final plat. Plat alterations are a Type III decision and processed as provided in RCW 58.17.215. The engineering plans showing the proposed changes shall be submitted with the plat alteration application.

Please note: The plat alteration application shall be submitted separately from the preliminary short plat application and the plat alteration decision shall be issued prior to the preliminary short plat application submittal.

Preliminary Short Plat

The following comments are based on the site plan materials submitted with this Pre Application:

1. The preliminary short plat drawings must meet the density and dimensional standards for single-family lots listed in Exhibit B of the approved Development Agreement (DA) recording number 6248594 AMD.
    a. Exhibit B supersedes the dimensional standards shown on the master plan (Exhibit C). Therefore, the front yard setbacks shall be 15-feet, not 10-feet as proposed.
    b. Exhibit B does not list a rear yard setback. As such, staff finds the rear yard setbacks shown on Exhibit C (the proposed site plan) of the DA are applicable, except for potentially lots 4-8 as follows:
        i. Per Section 4.2 of the DA, lots 4-8 are considered double frontage lots and therefore the setback requirements in CMC 17.09.030.D.6 are applicable. If a sight-obscuring fence or masonry wall is provided along the rear lot lines of lots 4-8, the City may consider a deviation of the requirements in CMC 17.09.030.D.6.
2. Per Section 4.2 of the DA, two-inch caliper trees are required to be planted in the rear lots backing NW Camas Meadows Drive. Those trees shall be treated as street trees (i.e. regarding placement, species, etc.)
3. Side lot lines shall be radial to curved streets per CMC 17.19.030.D.2.
4. Building envelopes (setbacks) shall be shown on the preliminary and final plats. Per CMC Section 17.19.030.D.3.a, a 40ft. by 40ft. square dwelling should be able to fit within the building envelope.
5. Each dwelling unit within a new development shall be landscaped with at least one tree per CMC 17.19.030.F.
6. A Pocket Park shall be provided per Section 4.3 of the DA.

Landscaping Regulations

A landscape plan shall be prepared in accordance with CMC Chapter 18.13 and the landscaping requirements in the DA.

Parking Regulations

The proposed use will need to meet the automobile parking requirements pursuant to CMC Chapter 18.11. The number of off-street parking spaces is calculated based on the table at CMC 18.11.130 Standards.

SEPA

The City issued a Determination of NonSignificance (DNS) on January 12, 2016, as file #SEPA15-14 for the Master Plan and therefore additional SEPA review is not required. However, if more adverse environmental impacts are identified, then SEPA will be required.

Archaeological Review

Although the site is located in an area of high probability for the presence of archaeological objects, an archaeological predetermination study was prepared with the original Parklands at Camas Meadows Master Plan (DA15-03). Therefore, a new archaeological study is not necessary.

ENGINEERING DIVISION **ANITA ASHTON (360) 817-7231 aashton@cityofcamas.us**
ERIC DUGGER (360) 817-7442 edugger@cityofcamas.us

The following requirements apply to the Plat Alteration application.
Said plat alteration application is required for removal of any/all easements, both public and private, over the trail accesses and stormwater conveyance system.

General Requirements:

1. Final engineering site improvement plans shall be prepared in accordance with the Camas Design Standards Manual (CDSM) and CMC 17.19.040, by a licensed Civil Engineer in Washington State.
2. ***Civil construction plans are not to be submitted until after Planning issues the land-use decision.***
3. CDev Engineering Dept. is responsible for plan reviews (PR) and construction inspections (CI) of the civil site improvements.
4. A 3% PR&CI fee is collected by engineering for all infrastructure improvements.
    a. A stamped preliminary engineer's estimate is to be submitted with the plans for first review.
    b. Payment of the 1% plan review (PR) fee shall be due prior to the start of the first review. Staff will review and approve the estimate and invoice the applicant.
    c. Payment of the 2% construction inspection (CI) fee is due prior to construction plan approval and release of approved plans to the applicant's consultant. Staff will invoice the applicant.
    d. Under no circumstances will the applicant be allowed to begin construction, including any land-disturbing activities prior to engineering plan approval.
5. If applicable work on the existing storm main within the city right-of-way (ROW) will require submittal an encroachment permit and an approved traffic control plan (TCP), prior to the start of any work.
    a. This permit is not to be submitted via the online portal. It is to be submitted to the future site Inspector for review and approval prior to pre-construction meetings.

Stormwater:

1. The applicant is responsible for re-routing of the existing stormwater system that traverses original Lots 43 and 44 of the Estates at the Archery.
2. Staff suggests the following options:
    a. If rerouting the conveyance systems that currently impacts the proposed building envelopes for proposed Lots 1, 2, 3, 5, and 6, the applicant's consultant is to work with staff to provide stormwater plans for review and approval for rerouting the stormwater conveyance system and manholes.
    b. To avoid rerouting the stormwater conveyance systems, the applicant's consultant to work with staff to reconfigure/relocated the proposed private street and the building envelopes of Lots 1, 2, 5, and 6.
3. The stormwater easements, which include the conveyance systems and manholes that traverse the proposed development convey stormwater runoff from 5 developments on the south side of NW Camas Meadows Drive, the runoff from NW Larkspur Street and NW Camas Meadows Drive, and runoff from 3509 and 3517 NW Camas Meadows Drive.
4. The stormwater conveyance systems and manholes that traverse the proposed development, are as follows:
    a. A 24-inch perforated pipe dispersion system within a 10-foot storm easement running along the north property line of the proposed development, Lots 1, 2, &3. This catches

and disperses stormwater from Camas Meadows Drive, a portion of McMaster Drive, the developments on the south side of Camas Meadows Drive, as well as from NW Pittock Place and lots 1-5 of Parklands.

b. A pair of 15-inch storm conveyance pipes within 10-foot storm easements running from a storm manhole near the center of the development to the 24-inch perforated pipe dispersion system.

c. An 18-inch storm conveyance pipe within a 10-foot storm easement running across the proposed development from Camas Meadows Drive near the existing driveway access to an existing storm manhole near the center of the development. This conveys stormwater from Camas Meadows Drive, the developments on the south side of Camas Meadows Drive to the dispersion system.

d. An 18-inch storm conveyance pipe within a 10-foot storm easement running along the east side of the proposed 'pocket park for the proposed development from Camas Meadows Drive and NW McMaster Drive and Lot 45 of the Archery at Parklands to the 24-inch dispersion system.

e. A 10-inch storm conveyance pipe from a manhole in NW Pittock Place running to the storm manhole near the center of the development. This conveys stormwater from NW Pittock Place as well as lots 1-5 of Estates at the Archery to the dispersion system.

The following requirements apply to the future preliminary short plat application.

General Requirements:

1. Final engineering site improvement plans shall be prepared in accordance with the Camas Design Standards Manual (CDSM) and CMC 17.19.040, by a licensed Civil Engineer in Washington State.
2. ***Civil construction plans are not to be submitted until after Planning issues the land-use decision.***
3. ***After the land-use decision is issued, the applicant is to submit civil construction plans via the online portal at www.cityofcamas.us/Permits under the 'Civil Construction Application'.***
4. CDev Engineering Dept. is responsible for plan reviews (PR) and construction inspections (CI) of the civil site improvements.
5. A 3% PR&CI fee is collected by engineering for all infrastructure improvements.
   a. A stamped preliminary engineer's estimate is to be submitted with the plans for first review.
   b. Payment of the 1% plan review (PR) fee shall be due prior to the start of the first review. Staff will review and approve the estimate and invoice the applicant.
   c. Payment of the 2% construction inspection (CI) fee is due prior to construction plan approval and release of approved plans to the applicant's consultant. Staff will invoice the applicant.
   d. Under no circumstances will the applicant be allowed to begin construction, including any land-disturbing activities prior to engineering plan approval.
6. *Per CMC 17.21.060.H Except for one sales office or one model home, building applications will not be accepted until after Final Acceptance has been issued for all infrastructure improvements.*
7. *Final acceptance is issued by the Community Development Engineering Dept.*
8. 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.
9. If required for work on the existing storm main, work within the city right-of-way (ROW) will require submittal an encroachment permit and an approved traffic control plan (TCP), prior to the start of any work.

a. This permit is not to be submitted via the online portal. It is to be submitted to the future site Inspector for review and approval prior to pre-construction meetings.

10. Regulations for installation of public improvements, improvement agreements, bonding, final plating, and final acceptance can be found at CMC 17.21.
11. The applicant will be responsible for ensuring that private utilities; underground power, telephone, gas, CATV, interior street/parking lighting, and associated appurtenances are installed.

Neighborhood Traffic Management Plan

The city has a Neighborhood Traffic Management Plan (NTM). The NTM plan identifies the need for installation of acceptable traffic calming features when a proposed development will create 700 Average Daily Trips (ADT) or more.

1. The proposed development will not result in 700 or more ADTs, therefore traffic calming features are not required.

Traffic/Transportation:

1. A Transportation Impact Analysis (TIA) is not required as the proposed development will not result in 199 vehicle trips per day (VPD) or more.
2. However, the Applicant will be required to have a traffic engineer analyze the following:
   a. Site distance access at applicants proposed access intersections.
   b. Vision clearance areas are to be addressed, per CMC 18.17.030.
   c. A traffic circulation plan showing on-site movements, and ingress and egress to the proposed development, per CMC 17.19.040 (B.10.a).
   d. Address movement conflicts with existing nearby intersections; and
   e. Provide trip AM and PM Peak distribution to and from the site.
   f. AM and PM Peak Hour analysis for intersections with 20 or more additional trips
3. COV will require trip distribution numbers to the following proportionate share intersections be included in the preliminary TIA:

Proportionate Share Project Name	Fee Rate	Number of Trips	Proportionate Share Cost
137th Ave – from NE 49th St to Fourth Plain Blvd	$3,000 per PM peak hour trip		
Fourth Plain Blvd & NE 152nd Ave	$333 per PM peak hour trip		
Leiser / St. Helens / MacArthur	$2,000 per PM peak hour trip		
SE 176th Ave & SE 20th St	$400 per PM peak hour trip		
NE 192nd Ave & NE 13th St	$400 per PM peak hour trip		
SE 192nd Ave & SE 34th St	$150 per PM peak hour trip		
192nd Ave & SR-14 ramp terminals	$2,000 per PM peak hour trip		
SE 192nd Ave & Columbia Palisades Dr. (**east/west legs only**)	$830 per PM peak hour trip		
MacArthur Blvd & Andresen Rd Roundabout	$2,285 per PM peak hour trip		
MacArthur Blvd & Devine Rd Roundabout	$2,226 per PM peak hour trip		
Grove St / Columbia House Blvd / SR-14 WB off-ramp	$600 per **AM** peak hour trip		
NE 172nd Ave & NE 18th St	$300 per PM peak hour trip		
NE 179th Place & NE 18th St	$900 per PM peak hour trip		
NE 187th Ave & NE 18th St	$1,200 per PM peak hour trip		
NE 162nd Ave & NE 9th St	$1,500 per PM peak hour trip		
NE 172nd Ave & NE 9th St	$4,100 per PM peak hour trip		
NE 192nd Ave & NE 9th St	$1,100 per PM peak hour trip		
NE 187th Ave & SE 1st St	$ 1,100 per PM peak hour trip		
Total Proportionate Share Cost			**$XXXX**

Streets:

1. The proposed development is located on the north side of NW Camas Meadows Drive, which is classified as a fully improved Arterial, per the 2016 Comp Plan Map.
    a. There is an existing commercial driveway approach that was constructed with the 2019 NW Camas Meadows Drive Road Improvements. The commercial driveway approach was intended to be a shared access between Lots 43 and 44.
        i. The commercial approach is to be removed and replaced with full height curb and gutter, planter strip, and sidewalk as part of the proposed development.
2. A driveway approach, sidewalk, and paved turnaround was constructed on the west side of NW McMaster Drive with the Parklands subdivision.
    a. The paved turnaround is located on Lot 44 and was constructed to allow delivery vehicles to turn around prior to the gated entry.
    b. The paved turnaround is not shown on the proposed site plans. The applicant is required to maintain an approved turnaround prior to the gated access to Lots 6-42 of Parklands subdivision.

Proposed Private Street

1. The proposed development is shown to take access from NW Pittock Place, which is an existing private road that provides access to Lots 1-5 of Parklands and measures 42-feet in width with approximately 28-feet of paved surface with a planter strip and sidewalk on one side only.

2. Per CDSM, Table 3 Access Spacing Standards the intersection setback from an Arterial is 300 feet.
    a. The intersection of the proposed private road is setback approximately 180-feet from the centerline of NW Camas Meadows Drive on NW Pittock Place.
    b. The setback for the new private road does not meet the intersection setback requirements from an arterial.
        i. A deviation request from the intersection setback standards to the city engineer is required.
        ii. The city engineer would support the deviation request.
3. The proposed private road is approximately 500-feet in length as measured from the existing centerline of NW Pittock Place, with 8 future single-family lots (Lots 1-8)
4. Per CMC 17.19.040.B Streets, private roads shall meet the requirements as shown on Table 17.19.040-1 'Minimum Private Street Standards - D', Access to 5 or more dwelling units, greater than 300-feet in length requires:
    a. 48-foot-wide tract width, 28-foot-wide paved surface, 5-foot-wide sidewalks and planter strips on both sides of the road, and parking permitted on one side only.
5. The applicant has proposed constructing the Private Street as follows: 42-foot tract width with a 28-foot paved surface with a 7-foot planter strip and a 5-foot sidewalk on one side only.
    a. As proposed, the future private road does not meet the minimum standards as shown on Table 17.19.040-1 'Minimum Private Street Standards - D'.
    b. A deviation request from the minimum Private Road Standard D, as noted above, is to be submitted to the city engineer.
        i. The city engineer would support the deviation request as the site plan included with the DA shows the future private road as less than Private Road Standard D.
6. Per CDSM, Table 1 Guidelines for Private Roads, Note 3 A dead-end turnaround will be required as the road is in excess of 150-feet as measured from the centerline of the adjacent road.
7. Per CMC 17.19.040.B.10.b.iii cul-de-sacs and dead-ends over 300-feet require a bicycle and pedestrian connection to the nearest available street.
    a. The east end of Proposed private road is approximately 500-feet from the intersection of NW Pittock Place to the dead-end turnaround. A pedestrian/bicycle connect is required to the nearest roadway.
8. Street tree planting is required in accordance with CMC 17.19.030.F.
9. Off-street parking requirements are to be per CMC 18.11.100.
10. LED street lighting is to be installed along the proposed private street frontage within the proposed development, in accordance with CDSM, Lighting Standards.

Stormwater:

1. The combined site of the proposed development is approximately 3.25 acres in size.
2. The applicant shall submit a preliminary stormwater report (PTIR) in accordance with CMC 14.02 Stormwater Control and the most current edition of Ecology's *Stormwater Management Manual for Western Washington* ***(latest edition 2024 SWMMWW*)**.
3. Stormwater treatment and detention shall be designed in accordance with the latest edition of Ecology's ***Stormwater Management Manual for Western Washington (2024 SWMMWW). Stormwater requirements are not vested to the original development.***
4. Refer to Ecology's *Figure I-3.2 Flow Chart for Determining Requirements for New Development (Vol. I, Chapter 3, Page 109)*.
    a. As the project will result in 5,000 sf, or greater, of new plus replaced hard surface area; then all Minimum Requirements (#1-#9) will apply.

5. Per CMC 17.19.040.C.3.a Stormwater facilities are to be placed in a Tract, with right-of-entry granted to the City for inspection purposes.
6. Per CMC 14.02.090 ownership and maintenance of onsite stormwater facilities will be the responsibility of the Owner/HOA, per CMC 17.19.040.C.3.
7. Public and private storm easements, if required, are to be shown on the final engineering plans.
8. Provisions are to be provided for roof downspout controls. Stormwater from downspouts is not to be directed onto adjoining parcels. Reference CMC 14.02 and 17.19.040.C for roof downspout controls.

Erosion Control:

1. The combined site of the proposed development is approximately 3.25 acres in size.
2. Per CMC 17.21.030.B an erosion and sediment control (ESC) bond, in the amount 200% of the engineer's estimate for ESC measures, is to be submitted prior to any land-disturbing activities.
3. As the land-disturbing activities are greater than one acre, the applicant will be required to obtain an *NPDES Construction Stormwater General Permit* from Ecology, which includes the *Stormwater Pollution Prevention Plan (SWPPP)*. Copies of both are to be submitted to Engineering prior to any land-disturbing activities.
4. 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.
5. Mud tracking onto the road surface is discouraged and any mud tracking is to be cleaned up immediately.

Water:

1. There are (2) 8-inch DIP water mains stubbed to the proposed development, as follows:
    a. An 8-inch DIP water main stubbed from NW Pittock Place near the proposed access to the development, which was for the benefit of commercial Lot 43.
    b. An 8-inch DIP water main stubbed from NW McMaster Drive along the eastern edge of the proposed development, which was for the benefit of commercial Lot 44.
2. Per CMC 17.19.040.C.4.a Each lot within a proposed development shall be served by a water distribution system designed and installed in accordance with city design standards.
    a. The applicant will be required to design and construct a minimum 8-inch ductile iron water main to serve the proposed development.
    b. The applicant shall provide a separate 1-inch water service and install water meter boxes for each of the single-family residential lots located within this development.
3. The applicant may be required to provide new fire hydrants located within the proposed development, per the CDSM and the FMO.
4. Landscaping in open space tracts must have a separate irrigation service, backflow prevention device, meter box and irrigation meter.
    a. The owner of the tract is responsible for payment of all fees associated with the installation of the meter and the water usage.
    b. Irrigation meters are to be owned by the HOA.
5. All trenching, backfill, and surface restoration on NW Camas Meadows Drive and/or NW Pittock Place are to be per CDSM Detail G2 and G2A.
6. A 10-foot separation shall be maintained between water and sanitary sewer lines.

Sanitary Sewer:

1. There are (2) existing 2-inch PVC pressure sewer services stubbed to the proposed development, as follows:
    a. A 2-inch PVC sewer lateral was stubbed from Camas Meadows Drive into proposed Lot 4

b. A 2-inch PVC sewer stub from Camas Meadows Drive into proposed Lot 6 just east of the existing driveway access

2. All trenching, backfill, and surface restoration on NW Camas Meadows Drive and/or NW Pittock Place are to be per CDSM Detail G2 and G2A.
3. A 10-foot separation is required, within the right-of-way and the private road serving the development, between the water service and sewer lateral.

Parks/Trails:

1. The applicant will be required to continue the existing 6-foot wide regional trail located within the wetland buffer that abuts the Parklands at Camas Meadows.
2. The existing pedestrian trail ends at the eastern property line between Lots 6 and 7. The trail is to be continued west behind future Parkland II Lots to the westernmost property line of Parklands Lot 3.

City Approved Tapping Contractors:

1. A&A Drilling Services, Inc (water & pressure sewer):
   16734 SE Kens Ct. #B, Milwaukie, OR 97267, 800-548-3827,
   http://www.aadrilling.com
2. Ferguson Waterworks (water only):
   14103 NW 3rd Court, Vancouver, WA 98685, 360-896-8708,
   https://www.ferguson.com/branch/nw-3rd-ct-vancouver-wa-waterworks

Garbage and Recycling:

1. Garbage and recycling receptacles are to be placed at the city right-of-way for pickup.

Impact Fees & System Development Charges (SDCs):

1. This development is in the North District.
2. Impact fees and SDCs are collected at time of building permit issuance.
3. The impact fees and SDCs noted below are for informational purposes only.
4. **Impact fees and SDCs are adjusted on January 1st of each year.**

Impact Fees for 2025 (South District):

Single Family:

1. Traffic Impact Fees (TIF) - $4,102.00
2. School Impact Fees (SIF) – $6,650.00
3. Park/Open Space (PIF) – Residential Scaled by Square Footage
   a. 0 to 1,000 sf - $4,259.00
   b. 1,001 to 2,000 sf - $7,802.00
   c. 2,001 to 2,600 sf - $11,841.00
   d. 2,601 sf and above - $13,549.00
4. Fire (FIF) - $0.71 psf

System Development Charges (SDCs) – 2025 Charges:

1. Water –
   a. 3/4” meter - $9,337.00 + $495 connection fee
   b. 1” meter - $15,560.00 + $552 connection fee
2. Sewer – Residential
   a. Residential - $7,407.00 + STEF Inspection

BUILDING DIVISION **BRIAN SMITH (360) 817-7243**

Building has no comments at this time.

FIRE DEPARTMENT **RANDY MILLER (360) 834-6191**

1) A separate gate permit is required for the changes required to the NW McMaster Drive Gate as a result of this Parklands II subdivision project. These changes are in regards to the East end of the subdivision affecting the turnaround and relocation of the gate pedestal.
2) For any required Blasting a permit with the fire Marshals Office is required. Please submit this as early as possible, a third party review may be required.
3) Any existing structures scheduled for demolition may be considered for use as a fire department training burn. Contact DFM Randy Miller at the FMO for further information. 360-834-6191
4) NFPA 13D Residential Fire Sprinklers required in all new dwellings. Additionally, it is recommended or may be required to mitigate access issues, turnaround issues or other non-compliant issues to install fire sprinklers in garages, all closets, all bathrooms and any covered outdoor living area. Contact the FMO for further information.
5) If a larger water meter is required to meet fire flow design and the larger meter is not required for reasons of the international residential code/building department, the SDC up-charge fees are waived, the minimal cost difference in the actual meter shall be paid.
6) A flow switch is optional but recommended to tie into the homes security system and or an outside bell.
7) If a PRV is installed, it shall be installed after the fire line supply. If the pressure is over 80 PSI a PRV may be needed on the toilet supply line supplied from the fire sprinkler system.
8) An inside bell or horn strobe is recommended (If system is not tied into a security system) Contact Randy Miller in the FMO for more information.
9) Water supply line from the meter into the structure shall be sized per the fire sprinkler contractors design calculations or a 2- inch line shall be installed.
10) Existing hydrant may suffice however an additional hydrant may be required during the construction review based on our department's operational needs.
11) Witnessed hydrant flushing required to be scheduled with the FMO on any new fire hydrant installation.
12) Access roads or flag lots to be a minimum 12-foot wide paved with a 20-foot wide clearance and a minimum 13.6-foot vertical clearance. These minimums may be greater per city of Camas engineering department where the more restrictive shall apply.
13) Approved Fire Department turnaround required for dead end streets or access driveway over 150 ft to residential structures measured from the center line of where the access road leaves the public street. There may be some additional distance approved with added sprinkler coverage provided above the Basic 13D requirements and may include garages full coverage or dry sidewalls if not heated space above the garage), all bathrooms, all closets, any outdoor living/kitchen area with dry sidewalls. A Platt note shall denote the lots requiring this extra coverage if utilized in the design and approved by the FMO.
14) Provide approved radiuses to access roads/driveways or tracts.
15) Obstructed access plan required for all private roads, flag lots serving more than one home or access tracts. Towing signs are the recommended plan unless an alternate method is provided and approved.

16) Any discovered underground oil or fuel storage tank requires a decommissioning permit through the Fire Marshal Office.
17) A propane Permit is required with the Fire Marshals Office for any tank installation over 124 gallons.
18) Temporary Addresses required at all times for each structure/lot until permanent address numbers are installed, please give attention to making the numbers extremely visible from the street and unlikely to be blocked by parked vehicles so emergency services can easily see and read. Illumination of address numbers is not yet code required however it is highly recommended.
19) For a courtesy list of 13D installers that have been installing systems in Camas and Washougal please contact our admin specialist at 360-834-6191 Option 2.
20) Please do not hesitate to contact the FMO if you have any questions. 360-834-6191 or FMO@cityofcamas.us

CHARBONNEAU
ENGINEERING

3-30-26

FRANK R CHARBONNEAU
STATE OF WASHINGTON
17586
REGISTERED
PROFESSIONAL ENGINEER

MEMORANDUM

DATE March 30, 2026

TO Jon Ellsworth
MAS1 LLC
3405 NW McMaster Drive
Camas, WA 98607

FROM Frank Charbonneau, PE, PTOE

SUBJECT **Parklands ll Short Plat** FL2616
Traffic Assessment
NW Pittock Place, Camas

This memorandum presents traffic analysis assessment for the Parklands ll Short Plat subdivision to be located at addresses #3711 & #3815 NW Camas Meadows Drive in Camas. The current proposal includes construction of eight single-family homes. The proposed development will access NW Pittock Place at one location on the northerly side of the intersection of NW Camas Meadows Drive and Pittock Place.

The Parklands ll Short Plat property is highlighted on the attached vicinity map (Figure 'a'). Figure `b` presents the project site plan which illustrates the site's access alignment and lot positions for eight homes. Vehicular access to the site is controlled by driver-activated gates on Pittock Place approximately 100 feet from Camas Meadows Drive. The gates are illustrated on the site plan.

The site's anticipated buildout is projected in year 2027.

INTERSECTION SIGHT DISTANCE

The site's access will be placed on NW Pittock Place inside the activated set of gates. NW Pittock Place is a 200-foot-long dead-end street that accesses the NW Camas Meadows Drive traffic circle on the north side. With this design intersection sight distance (ISD) will not be a factor as all northbound traffic accessing NW Pittock Place must slow and/or stop for the gates. Drivers exiting the site access on Pittock Place will have an unobstructed sightline in both directions along Pittock Place, including towards the south and the gated area, and to the north towards the cul-de-sac. As a result no sight distance mitigation is necessary. Additionally, it is pointed out that the frequency of trips turning onto NW Pittock Place is very low. Based on five existing homes in the cul-de-sac the trips equate to one entering vehicle in the AM peak hour and three entering vehicles in the PM peak hour.

When the development is constructed, it will be necessary to maintain the required sight distance. Placement of any objects such as building structures, walls, signing, parking, above ground utilities, or landscaping elements that obstruct the sightlines is not permitted for safety purposes.

TRIP GENERATION

Trip rates presented in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 12th edition, year 2025 were utilized to estimate the site's trip generation. Table 1 presents the trip generation summary.

Table 1 Trip Generation Summary

ITE Land Use	Units (#)	Weekday						
		ADT	AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Single-Family (#210)	8							
Generation Rate [1]		9.09	0.70	27%	73%	0.93	62%	38%
Site Trips		**73**	**6**	2	4	**7**	4	3

[1] Source: *Trip Generation* , 12th Edition, ITE, 2025, average rates.

Development of the proposed homes is expected to generate 73 daily trips, six AM peak hour trips, and seven PM peak hour trips. The trip generation is based on engineering judgment, access location, and street connectivity within the surrounding area. The peak hour trip distribution is presented in Figure 1 included in the report's appendix. The AM peak hour and PM peak hour trip assignments are presented in Figure 2.

Additional appendix items include the Vicinity Map (Figure `a`) and the Site Plan (Figure `b`).

PROPORTIONATE SHARE INTERSECTION IMPACTS & FEE – CITY OF VANCOUVER

As required by the City of Vancouver (noted in the Camas pre-app staff report) it was necessary to document the number of peak hour trips impacting Vancouver's proportionate share intersections. The NW Pittock Place Short Plat is projected to impact one of the proportionate share intersections. A copy of the proportionate share intersections and the associated cost per trip is included Table 2 as follows.

The SR14 ramp terminal intersections at SE 192nd Avenue will be impacted by three trips in the PM peak hour and will be subject to the proportionate share amount of $6,000.

Table 2 presents the City of Vancouver's future intersection improvement locations, the proportion share cost per trip rates, and the Parklands II Short Plat peak hour trips for each intersection listed.

Table 2 Proportionate Share Intersections and Fee Summary

Intersection	Cost Per Trip	Peak Trips	Proportionate Share
AM PEAK HOUR			
Grove St / Columbia House Blvd / SR-14 WB off-ramp	$600.00	0	$0.00
PM PEAK HOUR			
137th Avenue - from NE 49th St to Fourth Plain Blvd	$3,000.00	0	$0.00
Fourth Plain Boulevard & NE 152nd Avenue	$333.00	0	$0.00
Leiser Rd/St. Helens Av/MacArthur Blvd (future)	$2,000.00	0	$0.00
SE 176th Avenue & SE 20th Street	$400.00	0	$0.00
NE 192nd Avenue & NE 13th Street	$400.00	0	$0.00
SE 192nd Avenue & SE 34th Street	$150.00	0	$0.00
SE 192nd Avenue & SR-14 ramp terminals	**$2,000.00**	**3**	**$6,000.00**
SE 192nd Avenue & Columbia Palisades Drive[1]	$830.00	0	$0.00
MacArthur Boulevard & Andresen Road roundabout	$2,285.00	0	$0.00
MacArthur Boulevard & Devine Road roundabout	$2,226.00	0	$0.00
NE 172nd Avenue & NE 18th Street	$300.00	0	$0.00
NE 179th Place & NE 18th Street	$900.00	0	$0.00
NE 187th Avenue & NE 18th Street	$1,200.00	0	$0.00
NE 162nd Avenue and NE 9th Street	$1,500.00	0	$0.00
NE 172nd Avenue and NE 9th Street	$4,100.00	0	$0.00
NE 192nd Avenue and NE 9th Street	$1,100.00	0	$0.00
NE 187th Avenue & SE 1st Street	$1,100.00	0	$0.00
PROPORTIONATE SHARE TOTAL			**$6,000.00**

[1] East and west legs only

INTERSECTION CRASH AND SAFETY ASSESSMENT

The latest available crash data was obtained from WSDOT for the traffic circle at NW Camas Meadows Drive, NW Payne Street and NW Pittock Place. The research period covered the five-year period of 1/1/20 to 12/31/24.

The crash report dated 3/24/26 confirmed that there were no reported crashes documented from the assessment. A copy WSDOT's response is contained in the appendix.

As a result of the findings no safety mitigation is recommended at the study intersection in conjunction with the proposed development.

RECOMMENDATIONS

The Parklands ll Short Plat proposes construction of eight single-family homes to be located on the northeast corner of the intersection of NW Camas Meadows Drive at NW Pittock Place and NW Payne Street. The proposed homes will access NW Pittock Place at one location as illustrated on the

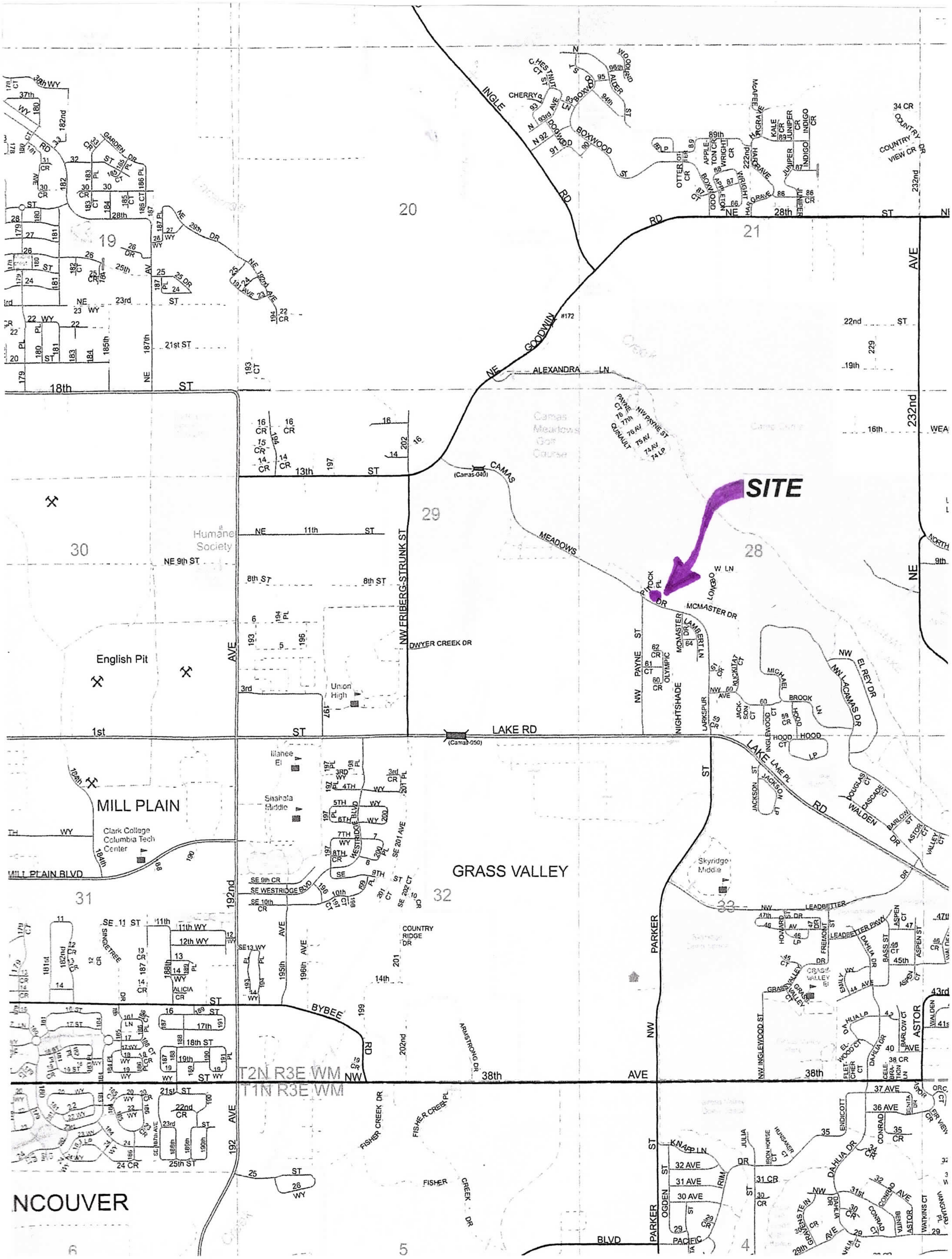
development's site plan. A gated access is currently present and will control all entries and exits to/from the neighborhood.

Based on the site's limited trip generation, unrestricted intersection sight distance, and absence of reported crash experience at the adjacent NW Camas Meadows Drive intersection it is recommended that the City of Camas approve the development without any improvements to the transportation system.

Please contact Frank Charbonneau PE, PTOE if you have any questions or comments.

Attachments

Figure `a` Vicinity Map
Figure `b` Site Plan
Figure 1 Trip Distribution
Figure 2 Trip Assignment
Traffic Scope Approval by City of Camas
Crash Data Summary, email statement provided by WSDOT



FILE NAME: 2608flow.dwg

PLOT DATE: 03.26.26

CHARBONNEAU ENGINEERING LLC

PROJECT: 26-08

NOTES:
NO SCALE

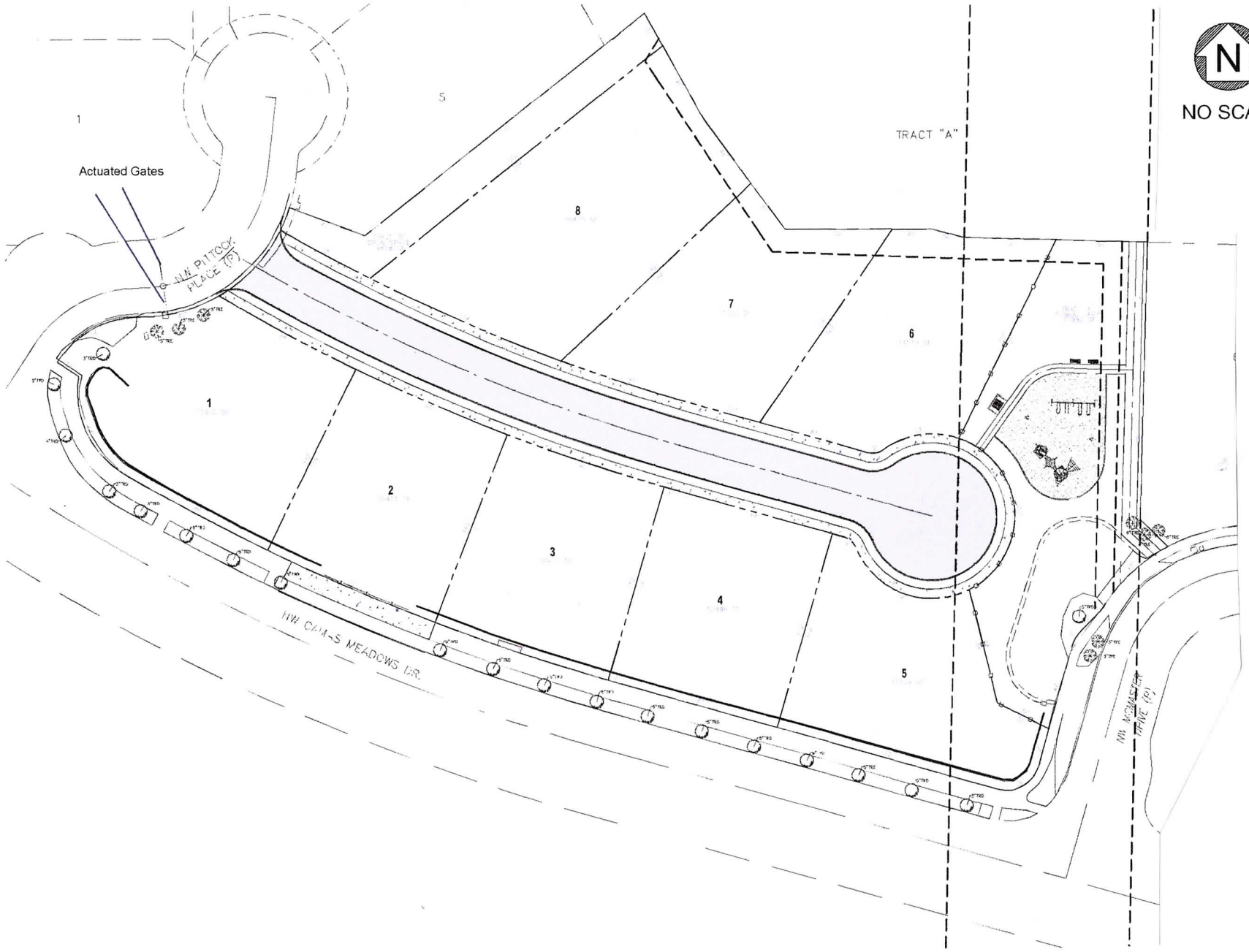
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VICINITY MAP
PARKLANDS II SHORT PLAT

FIGURE

a

PLOT DATE: 03.26.26 FILE: 2608flow.dwg



CHARBONNEAU ENGINEERING LLC

PROJECT: 26-08

NOTES: The site plan has been provided by SGA Engineering & Design.

SITE PLAN

PARKLANDS II SHORT PLAT - CAMAS

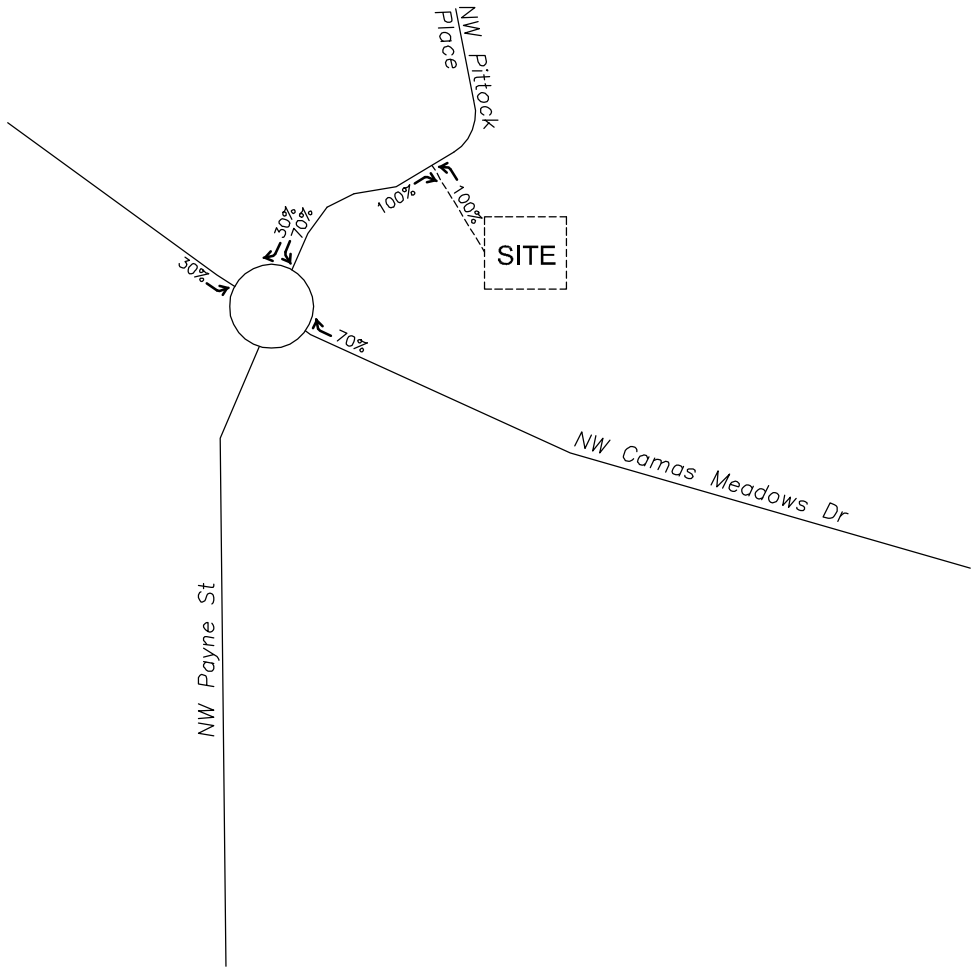
FIGURE b

Exhibit 7 SP26-1005

PLOT DATE: 03.26.26 FILE: 2608flow.dwg

N

NO SCALE



CHARBONNEAU ENGINEERING LLC

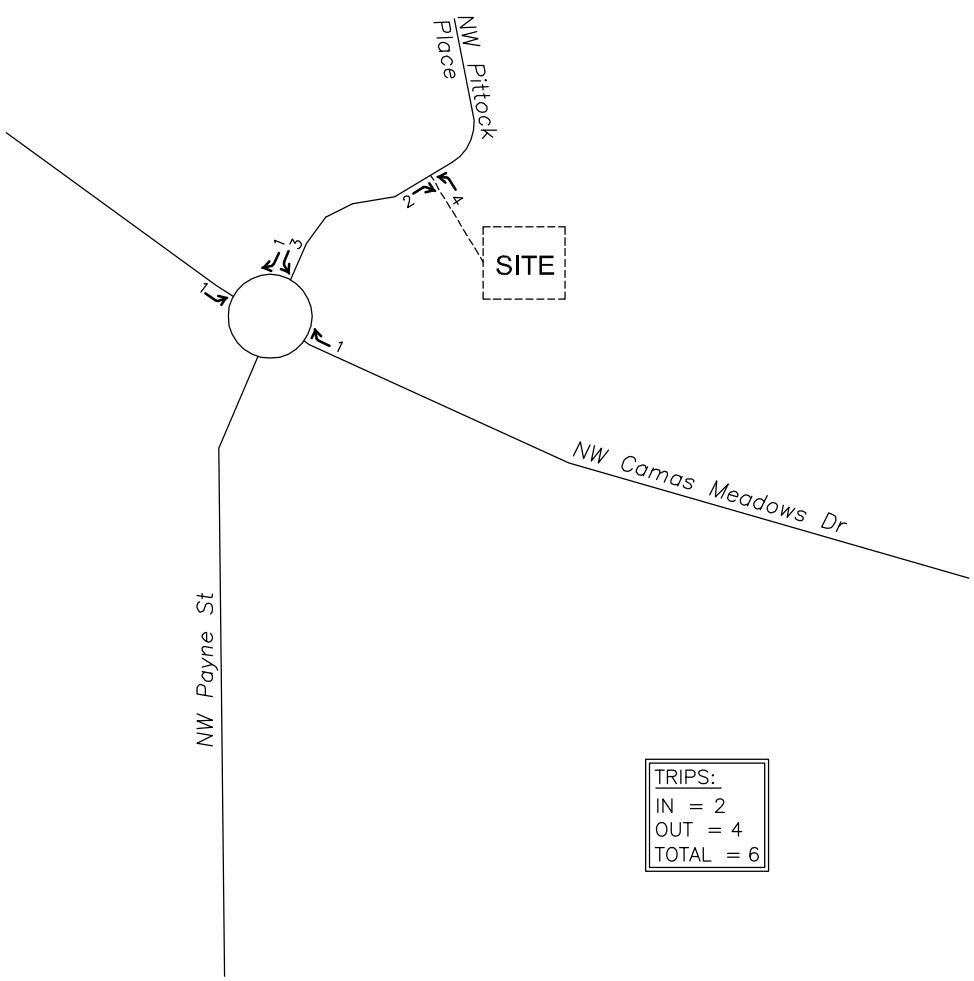
PROJECT: 26-08

NOTES: The site's trip distribution is based on engineering judgment.

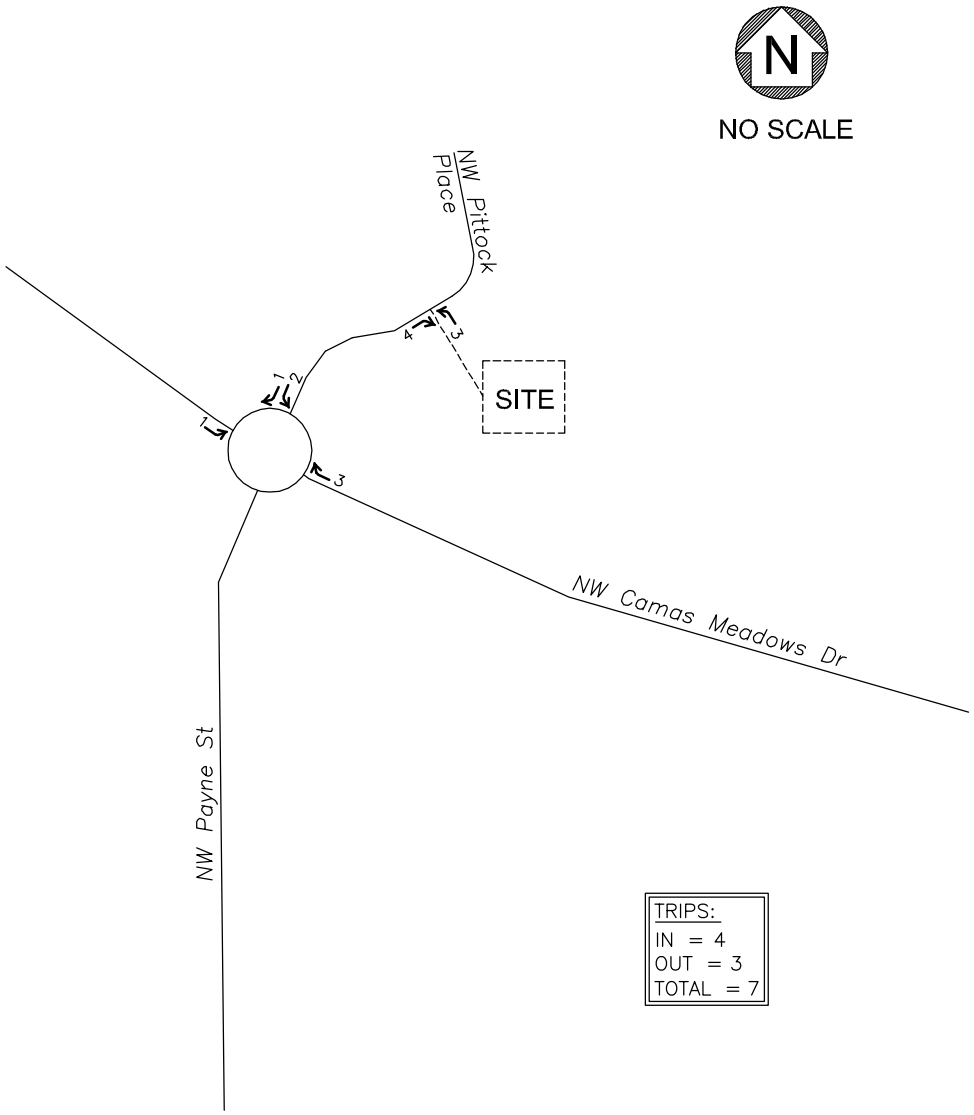
TRIP DISTRIBUTION
WEEKDAY AM PEAK HOUR AND PM PEAK HOUR
PARKLANDS II SHORT PLAT - CAMAS

FIGURE 38

PLOT DATE: 03.26.26 FILE: 2608flow.dwg



AM PEAK HOUR



PM PEAK HOUR

CHARBONNEAU ENGINEERING LLC

PROJECT: 26-08

NOTES: The site's trip generation is based on Single-Family Residential (ITE 210) trip rates.

TRIP ASSIGNMENT

PARKLANDS II SHORT PLAT - CAMAS

FIGURE 2

Frank Charbonneau

From: Anita Ashton <AAshton@cityofcamas.us>
Sent: Monday, March 30, 2026 2:12 PM
To: Frank Charbonneau; Curleigh (Jim) Carothers
Subject: RE: Parklands II Short Plat - Traffic Scope

Hey Frank,
Your scoping assumptions noted below are correct. Thanks

Anita Ashton
Engineering Project Manager
Community Development Dept.
Office Hours: 8:00-5:00, Closed 12:00-1:00
Desk 360-817-7231
www.cityofcamas.us | *aashton@cityofcamas.us*

The City of Camas has gone digital! Apply for permits online through our new Civic Access Portal at www.cityofcamas.us/permits.

From: Frank Charbonneau <frank@charbonneauengineer.com>
Sent: Wednesday, March 25, 2026 1:54 PM
To: Curleigh (Jim) Carothers <jcarothers@cityofcamas.us>; Anita Ashton <AAshton@cityofcamas.us>
Subject: Parklands II Short Plat - Traffic Scope

WARNING: This message originated outside the City of Camas Mail system. DO NOT CLICK on links or open attachments unless you recognize the sender and are expecting the content. If you recognize the sender as a city employee and you see this message this email is a phishing email. If you are unsure, click the Phish Alert button to redirect the email for ITD review.

Curleigh – Our run on Camas traffic work continues, and we very fortunate. Here's the anticipated scope for this small project (PA25-1057). A site plan and aerial map are attached for reference.

The site's access will be placed on NW Pittock Place inside the activated set of gates. NW Pittock Place occurs on the northerly side of the traffic circle on NW Camas Meadows Drive. With this design ISD will not be a factor as all entering traffic will slow and/or stop for the gates. The #trips entering equates to 2 vehicles in the AM peak and 5 vehicles in the PM peak. We will discuss this in the study. No speed survey will be necessary.

The development will build 8 single-family homes so obviously the trip generation is minimal at less than 80 ADT and less than 8 trips in the AM & PM peak hours. Therefore, no intersections will be evaluated for LOS or queuing.

We anticipate a technical traffic memo will suffice that documents the access ISD situation, trip generation, distribution at the traffic circle with NW Camas Meadows Drive, crash history & safety assessment for intersection at NW Camas Meadows Drive/Pittock Place/Payne Street intersection, and addressing Vancouver's proportionate share intersection trip impacts.

Please confirm if this scoping will be sufficient, and let me know if you have any comments/questions. Thank you.

Frank Charbonneau, PE, PTOE
Charbonneau Engineering
971.322.8003

NOTICE OF PUBLIC DISCLOSURE: This e-mail account is public domain. Any correspondence from or to this e-mail account may be a public record. Accordingly, this e-mail, in whole or in part may be subject to disclosure pursuant to RCW 42.56, regardless of any claim of confidentiality or privilege asserted by an external party.

Frank Charbonneau

From: WSDOT <wsdot@mycusthelp.net>
Sent: Friday, March 27, 2026 8:54 AM
To: Frank Charbonneau
Subject: [Records Center] Public Disclosure Request :: P020100-032426

--- Please respond above this line ---

RE: Public Disclosure Request of March 24, 2026, Reference #P020100-032426

Good morning Mr. Charbonneau,

In accordance with the Public Records Act (RCW 42.56), this letter acknowledges receipt of your request for records, Reference # P020100-032426, received 3/24/2026 concerning:

Please provide the latest 5 years of crash data at one intersection in Camas.
See attached crash request form and aerial map for location. Target Date = 4/7/26. Thank you.

We've done a thorough search of agency records, and no responsive records were located. The responding office replied "There were no reported crashes found on Camas Meadows Dr @ Payne St_Pittock Pl in the City of Camas for the period of 2020 - 2024 as of 03/26/2026."

With this communication, your request is considered closed. This is our final response. WSDOT does not intend to further address the request, and the PRA's one-year statute of limitations to seek judicial review has started to run as of the date of this correspondence.

If you have any questions, please reply to this email. Thank you and hope you have a great rest of your day.

Best regards,

Dawn Roberts
Public Disclosure Coordinator
Washington State Department of Transportation

To monitor the progress or update this request please log into the Public Disclosure Request Center

PARKLANDS II SHORT PLAT

PRELIMINARY TECHNICAL INFORMATION REPORT

Prepared for:

MASIA, LLC
JON ELLSWORTH
3405 NW MCMASTER DRIVE
CAMAS, WA 98607
(360) 798-2400
JONELLSWORTHRE@GMAIL.COM

Prepared by:

SGA ENGINEERING & DESIGN, PLLC
2005 BROADWAY
VANCOUVER, WA 98663
(360) 993-0911
JINTERMILL@SGAENGINEERING.COM



This project complies with Camas Municipal Code (CMC) 14.02 Stormwater Control and the July 2024 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW).

ENG #: TBD
DATE: 05/04/2026
JOB #: 2451

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Section G - Soils Evaluation 5

Section H - Special Reports and Studies 5

Section I – Other Permits 5

Section J – Groundwater Monitoring Program 5

Section K – Maintenance and Operations 5

Section L – Technical Appendix 5

Appendix A – Basin Map

Appendix B – Design Criteria

Appendix C – Design Calculations

Appendix D – Soils Report

Appendix E – Stormfilter Maintenance Manuals

SECTION A - Project Overview

The Parklands II Short Plat proposes to develop parcels 986043913 & 986043914, approximately 3.24 acres total, into an 8-lot short plat. The two parcels had been recorded as lots 43 and 44 of the Estates at the Archery final plat and part of the Parklands at Camas Meadows approved final engineering design. The site is located at 3711 & 3815 NW Camas Meadows Dr, Camas, WA 98607. The site is bordered by developed residential lots, public and private roads on the west, south and east. Tract 'A' of the Estates at the Archery borders the site to the north which contains a wetland and previously mitigated buffer on the property line. The development does not propose any encroachments to the wetland buffer.

The site was mass graded with the original development and stabilized with grass. The grading plan consists of two terraced pads with the overall grades sloping south to north. Temporary erosion control measures are still in place to direct runoff to the northern boundary of the site. A dispersion trench was installed within a 10' storm easement on the northern perimeter of the parcels to disperse runoff to the existing wetlands, per the Final Stormwater Report for the Parklands at Camas Meadows. The existing dispersion trench was sized for the future, developed conveyance and quantity control of this project, as well as the surrounding developments. Each future development is responsible for providing enhanced water quality treatment for phosphorus removal. The existing conveyance pipes across the proposed the site to be developed will be rerouted across the site to best fit the new lot layout (along with the existing easements through a plat alt). The Parklands at Camas Meadows documented the entire basin as a flow control exempt basin, and modifications are proposed to the existing dispersion trench.

This project will consist of site grading, constructing roads, and utilities necessary to develop the site. Stormwater control will conform to the requirements of the 2024 Stormwater Management Manual for Western Washington. Contech Stormfilters will provide phosphorus removal for proposed pollution generating surfaces prior to conveyance to the existing dispersion trench on site. The developed site will propose less than or equal to the original impervious area included in the design for the proposed parcels in the Parklands at Camas Meadows Final Stormwater Design.

SECTION B – Minimum Requirements

Based on the project thresholds and the applicability criteria outlined in Volume I, Section I-3.3 and Figures I-3.1 and I-3.2 of the 2024 Stormwater Management Manual for Western Washington (SWMMWW), all Minimum Requirements #1 through #9 are triggered for this project.

Table A. – Surface Area Breakdown Onsite

Existing Impervious Surface	**0.00 Acres**
New Impervious Surface	**1.88 Acres**
Replaced Impervious Surface	**0.00 Acres**
***Native Vegetation Converted to Lawn or Landscaping**	**1.37 Acres**
Native Vegetation Converted to Pasture	**0.00 Acres**
Total Land-disturbing Activity	**3.25 Acres**

*The existing vegetation on site is grass from the stabilization of mass grading

1. Table B shows the effective impervious area on site and the increase in 100-year flood frequency from pre-developed to developed conditions.

Table B. – TDA Summary

TDA	Original Parklands Impervious Area	Proposed Impervious Area
POC 1	2.91 Acres	1.88 Acres

2. All TDAs must meet *Minimum Requirement #6: Runoff Treatment for Phosphorus Removal*
3. All TDAs are exempt from *Minimum Requirement #7: Flow Control with the basin release to Lacamas Lake, a flow control exempt water body, as approved through the Parklands at Camas Meadows Final Stormwater Report.*
4. All TDAs must meet Minimum Requirement #8: Wetland Protection.

Minimum Requirement 1. – Preparation of Stormwater Site Plans*:*
The final stormwater plan and final engineering plans with layouts and construction details will be prepared after the project receives preliminary approval.

Minimum Requirement 2. – Construction Stormwater Pollution Prevention*:*
A Construction Stormwater Pollution Prevention Plan (SWPPP) is required and will be prepared. The contractor will comply with construction SWPPP requirements including elements 1-13.

Minimum Requirement 3. – Source Control of Pollution*:*
All development activities shall comply with the applicable source control requirements of the City of Camas Municipal Code, City of Camas Engineering Design Standards, and the 2024 Stormwater Management Manual for Western Washington (SWMMWW), as adopted by the City. The BMPs that may apply to land disturbance could be **BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots, BMPs for Landscaping and Lawn/Vegetation Management, BMPs for Maintenance of Stormwater Drainage and Treatment Systems, BMPs for Urban Streets.** Refer to Section D of this report.

Minimum Requirement 4. – Preservation of Natural Drainage Systems and Outfalls*:*
The proposed improvements associated with this parcel will preserve the existing conveyance. Existing drainage patterns shall be maintained, and discharges from the project site shall occur as is, to the maximum extent practicable. The site runoff currently sheet flows to the northern

property line where an existing dispersion trench releases to the mitigated buffer, as approved and constructed through the Parklands at Camas Meadows project. Refer to Section L of this report.

Minimum Requirement 5. – Onsite Stormwater Management*:*
The BMPs that may apply to Onsite Stormwater Management for this project could include T5.13 - Post-Construction Soil Quality and Depth and T5.21 - Better Site Design. Onsite Stormwater Management is a means to implement inexpensive practices on individual properties to reduce the amount of disruption of the natural hydrology. Refer to Section E of this Report.

Minimum Requirement #6. – Runoff Treatment:
Since the thresholds for impervious area added exceeds the limits, enhanced treatment is required. The stormwater system ultimately discharges to Lacamas Lake, which requires phosphorus treatment. Enhanced treatment for phosphorus removal is proposed in the form of Contech Phosphosorb Stormfilter cartridges that will meet or exceed the required treatment parameters. Refer to Section F of this report.

Minimum Requirement #7. – Runoff Flow Control:
As documented by the Parkland at Camas Meadows Subdivisions' stormwater reports, this parcel is part of a flow control exempt TDA. The developed site will propose less than or equal to the original impervious area included in the design for the proposed parcels in the Parklands at Camas Meadows Final Stormwater Design. The previous layout with impervious area shown is in Appendix A. All treated runoff will be dispersed by the existing dispersion trench on site.

Minimum Requirement #8. – Wetlands Protection:
No wetlands exist on site. A wetland buffer is adjacent to the project. Wetland Protection was provided by the original development of the Parklands at Camas Meadows. There are no proposed modifications or disturbances to the wetland or wetland buffer adjacent to the project.

Minimum Requirement #9. – Operation and Maintenance:
The storm systems will be privately owned and maintained by a Homeowners Association. See Contech's website for maintenance on stormfilter catch basins. Operation and maintenance shall comply with City of Camas requirements and the 2024 SWMMWW.

SECTION C – Soils Evaluation

Refer to the Final Geotechnical Report by Columbia West Engineering, Inc dated June 23, 2015. for the full soils evaluation in Appendix D.

The Soil Survey of Clark County, Washington, November 1972 identifies the onsite soils as, Hesson Clam Loam (HcD, HcB). The hydrologic soil group for these soils is "C" and WWHM3 Soil Groups (SG) 3.

SECTION D – Source Control

All development activities shall comply with the applicable requirements of the City of Camas

Municipal Code and the 2024 Stormwater Management Manual for Western Washington (SWMMWW), as adopted by the City. The BMPs that may apply to land disturbance could be 'BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots,' 'BMPs for Landscaping and Lawn/Vegetation Management,' BMPs for Maintenance of Stormwater Drainage and Treatment Systems' and 'BMPs for Urban Streets'.

SECTION E - Onsite Stormwater Management BMPs

1. The following are a list of onsite stormwater management BMPs:

T5.13 – Post-Construction Soil Quality and Depth

2. Refer to Section C above for geotechnical information

3./4. **T5.13 – Post-Construction Soil Quality and Depth (Volume V, SMMWW)**

Since the majority of the site has been or will be stripped of topsoil and/or organic material for grading purposes, the remaining open spaces, yards, and landscaping areas shall be restored with the appropriate soil quality and depths.

T5.21 – Better Site Design (Volume V, SMMWW)

An attempt to provide better site design has been considered to the extent practical. Sensitive areas with wetlands and significant trees have been left out of the development.

5./6./7. A Contech Stormfilters stormwater system is proposed on this project. They are shown on the Stormwater plan.

8. N/A; no pervious pavement is proposed.

9. N/A; no reversed slope sidewalks are proposed.

SECTION F - Runoff Treatment Analysis and Design

1. Based on the proposed site conditions and use, phosphorous treatment is proposed.

2. Since the thresholds for impervious area added exceeds the limits, enhanced runoff treatment is required. The stormwater system will meet or exceed the required treatment parameters as described in the Washington State Department of Ecology 2024 Stormwater Management Manual for Western Washington (SWMM), Appendix III-C.

3. See Section C for Geotechnical information.

4. The following are the BMPs used in the design.

Contech Stormfilters

Table B. – Phosphosorb Stormfilter Details

Basin	Water Quality Flow Rate	PSORB Cartridges	Treatment Capacity
C	0.0678	2 – 27" PSORB	0.0840 CFS

5. Water quality treatment system design complies with the applicable requirements of the 2024 SWMMWW, including Volume V (Runoff Treatment BMPs) and Volume I (Minimum Requirements), and provides basic treatment and phosphorus removal as required.

6. See Water Quality Basin Map in Appendix C for pollution generating areas summary.

SECTION G - Flow Control Analysis and Design

Refer to the discussion above, Section C of this report for soils information.

As previously mentioned in Sections A and B of this report, Lacamas Lake is identified as a flow control exempt receiving water body. Since it is flow control exempt, no flow control detention or release rate control is required for this project. Runoff from Parklands II Short Plat will be conveyed through 12" and 18" ADS storm pipes on-site to the existing drainage system downstream, before ultimately being discharged to Lacamas Lake.

The site was analyzed as 1 TDA with the on-site predeveloped basin. All basins flow to the northeast corner of the site.

The site was evaluated using the continuous model using the WWHM2012 software. Electronic copies of the WWHM files will be submitted upon request.

SECTION H – Wetlands Protection

Since there are no Category I or II classified Wetlands on site, the provision for wetland protection is subject to whether or not the City determines protection is required, and to what extent.

The original Parklands TIR addresses their level of wetland protection, with details and calculations in appendix B-2 of their report. We are proposing to convey runoff into existing manholes within the existing storm lines A and B, which have already been designed to meet the previously required wetland protection requirements by the City of Camas.

There are wetlands located around the site, and wetland analysis has been provided in the Parklands Final Storm TIR to provide basic protection.

References

United States Department of Agriculture, Soil Conservation Service. "Soil Survey of Clark County Washington," Washington, D.C., 1972.

United States Department of Agriculture, Soil Conservation Service, Engineering Division, "Technical Release 55: Urban Hydrology for Small Watersheds, 2nd Ed.," Washington, D.C., 1986.

United States Department of Transportation, Federal Highway Administration, "Hydraulic Engineering Circular No. 12: Drainage of Highway Pavements," Springfield, VA, 1984.

United States Department of Transportation, Federal Highway Administration, "Hydraulic Engineering Circular No. 15: Design of Roadside Channels with Flexible Linings," Springfield, VA, 1984.

Washington State Department of Ecology. *Stormwater Management Manual for Western Washington (SWMMWW), 2024 Edition, Volumes I–V.* Olympia, WA, 2024Washington State Department of

Transportation, "Hydraulic Manual," Olympia, WA, 1989.

Clark County Department of Assessment and GIS, "2000 Clark County Road Atlas," Vancouver, WA, 2000.

Appendix A

General Location Map **A1**

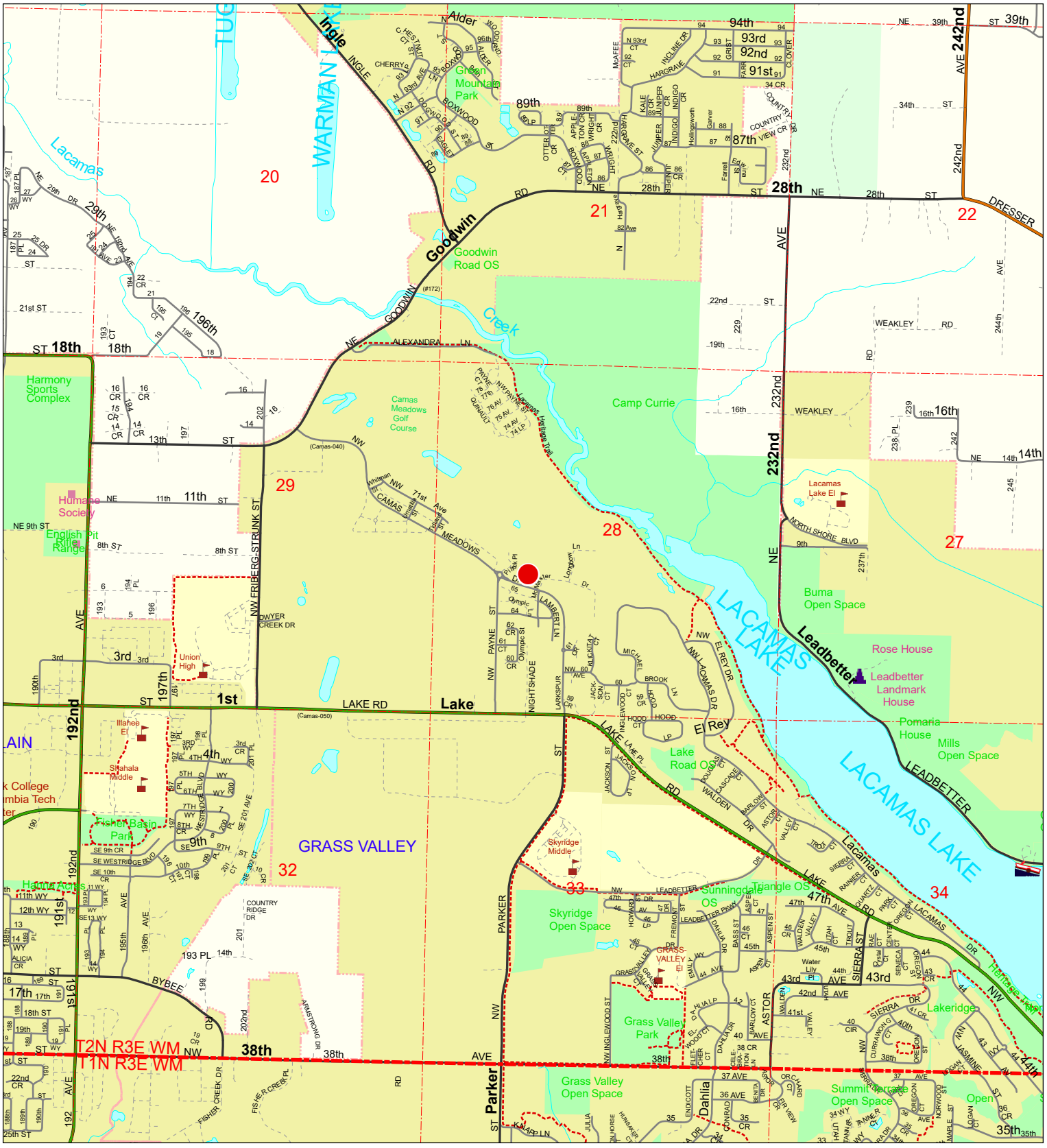
Elevation Contours Map **A2**

Soil Types Map **A3**

Pre-Developed Basin Map **A4**

Previously Analyzed Basin Map **A5**

Developed Basin Map **A6**

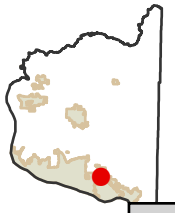


General Location

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

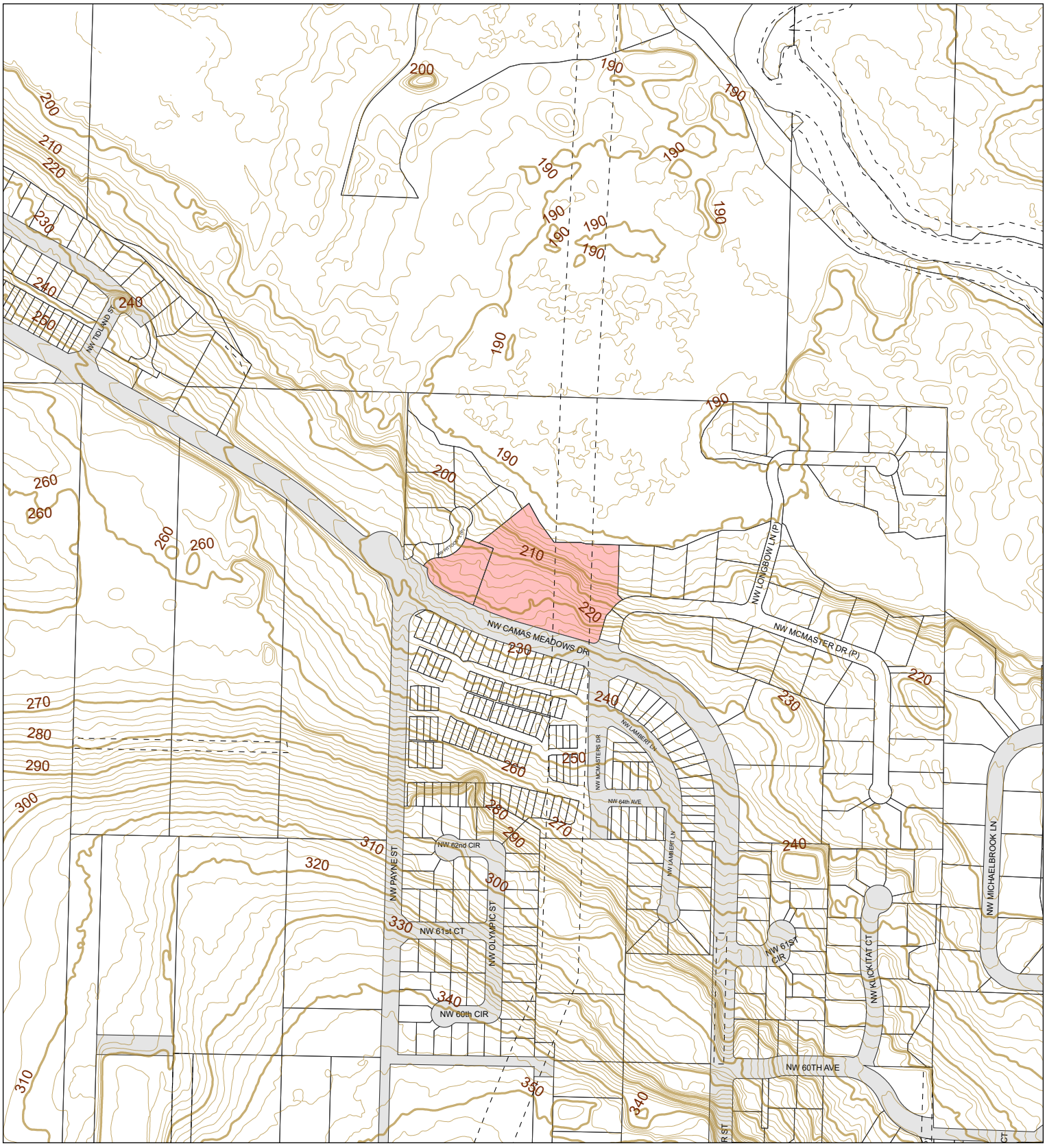
Location of Subject Property(s)



Geographic Information System

0 1,000 2,000 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



Elevation Contours

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

CLARK COUNTY, WASHINGTON
Geographic Information System

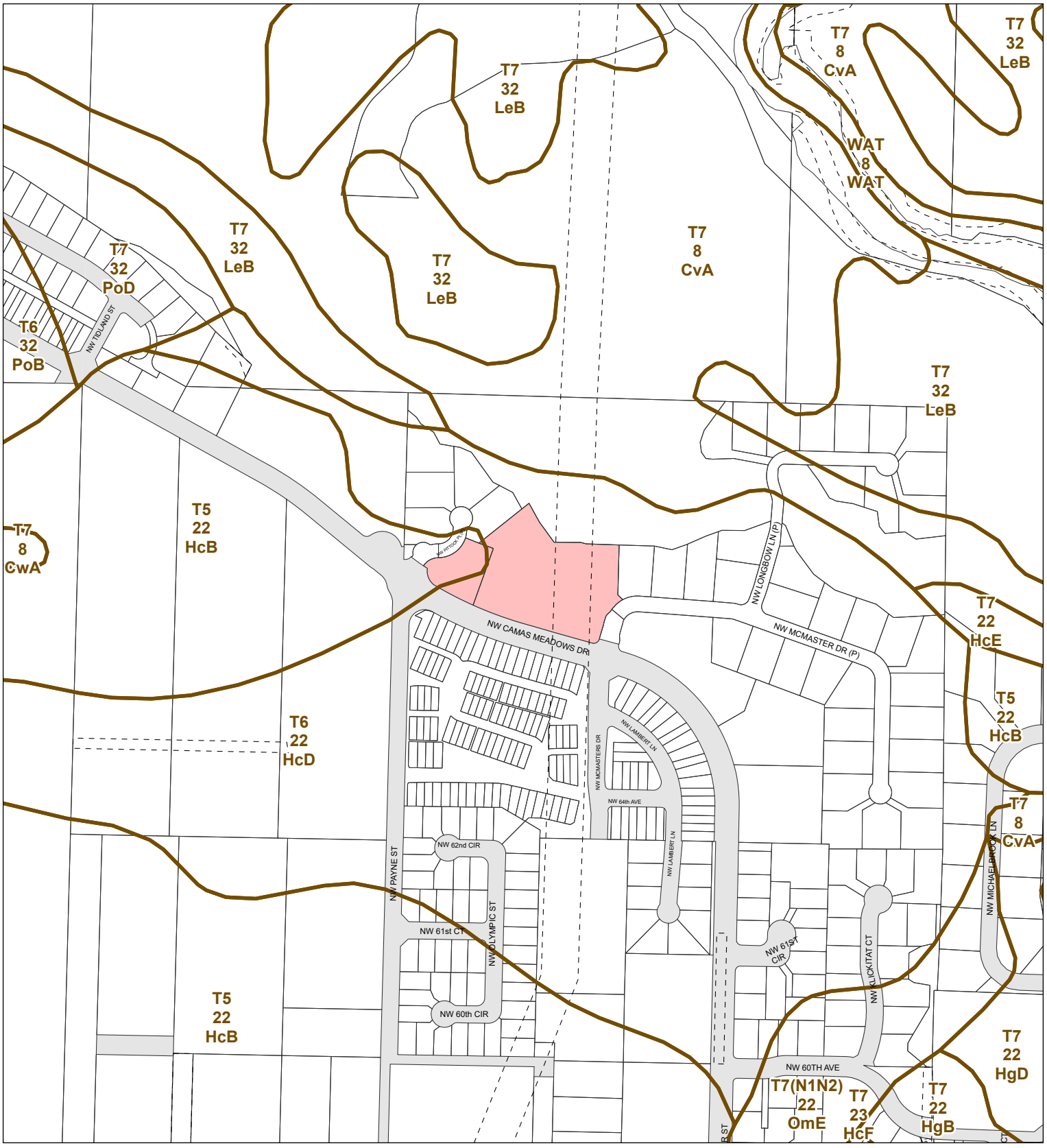
N

0 200 400 Feet

Subject Property(s)
Public Road
Transportation or Major Utility Easement
10' Elevation Contours
2' Elevation Contours

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



CLARK COUNTY, WASHINGTON

Geographic Information System

0 200 400 Feet

N

Soil Types

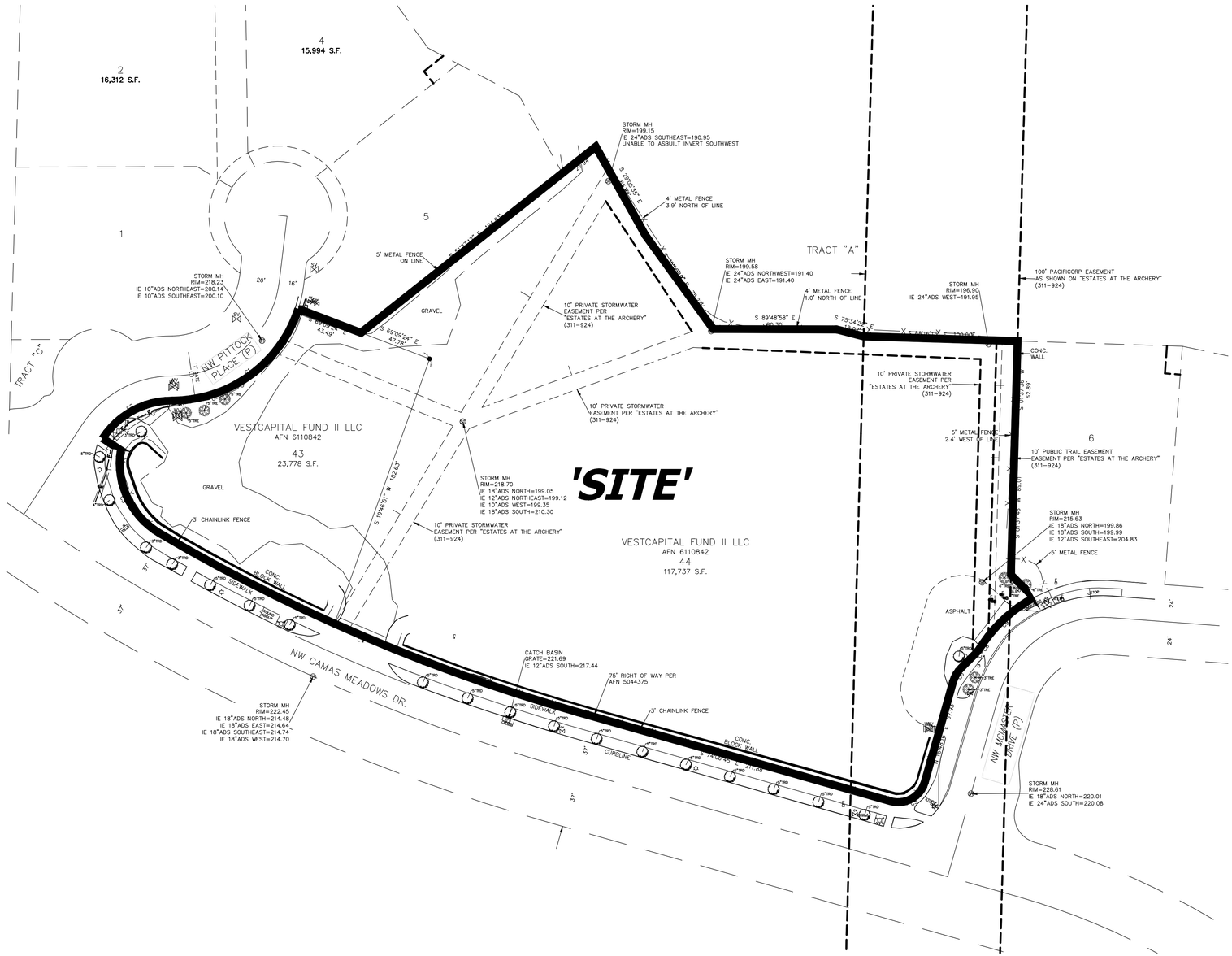
Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Subject Property(s)
Public Road
Transportation or Major Utility Easement
Soil Type Boundary

Printed on: November 04, 2025

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.


'SITE'
4
15,994 S.F.
2
16,312 S.F.
1
5
TRACT "A"
TRACT "C"
6
VESTCAPITAL FUND II LLC
AFN 6110842
43
23,778 S.F.
VESTCAPITAL FUND II LLC
AFN 6110842
44
117,737 S.F.
NW CAMAS MEADOWS DR.
NW PITTOCK PLACE (P)
NW MICHAELIS DRIVE (P)
STORM MH
RIM=199.15
IE 24"ADS SOUTHEAST=190.95
UNABLE TO ASBUILT INVERT SOUTHWEST
STORM MH
RIM=218.23
IE 10"ADS NORTHEAST=200.14
IE 10"ADS SOUTHEAST=200.10
STORM MH
RIM=199.58
IE 24"ADS NORTHWEST=191.40
IE 24"ADS EAST=191.40
STORM MH
RIM=196.90
IE 24"ADS WEST=191.95
STORM MH
RIM=218.70
IE 18"ADS NORTH=199.05
IE 12"ADS NORTHEAST=199.12
IE 10"ADS WEST=199.35
IE 18"ADS SOUTH=210.30
STORM MH
RIM=222.45
IE 18"ADS NORTH=214.48
IE 18"ADS EAST=214.64
IE 18"ADS SOUTHEAST=214.74
IE 18"ADS WEST=214.70
STORM MH
RIM=215.63
IE 18"ADS NORTH=199.86
IE 18"ADS SOUTH=199.99
IE 12"ADS SOUTHEAST=204.83
STORM MH
RIM=228.61
IE 18"ADS NORTH=220.01
IE 24"ADS SOUTH=220.08
CATCH BASIN
GRATE=221.69
IE 12"ADS SOUTH=217.44
4' METAL FENCE 3.9' NORTH OF LINE
4' METAL FENCE 1.0' NORTH OF LINE
5' METAL FENCE ON LINE
5' METAL FENCE 2.4' WEST OF LINE
3' CHAINLINK FENCE
CONC. BLOCK WALL
CONC. WALL
GRAVEL
ASPHALT
SIDEWALK
CURBLINE
10' PRIVATE STORMWATER EASEMENT PER "ESTATES AT THE ARCHERY" (311-924)
100' PACIFICORP EASEMENT AS SHOWN ON "ESTATES AT THE ARCHERY" (311-924)
10' PUBLIC TRAIL EASEMENT EASEMENT PER "ESTATES AT THE ARCHERY" (311-924)
75' RIGHT OF WAY PER AFN 5044375
S 29°07'35" E 182.63'
S 19°46'51" W 182.63'
S 69°09'24" E 43.49'
S 69°09'24" E 47.78'
S 89°48'58" E 180.20'
S 75°43'22" E 184.21'
S 01°37'48" W 202.89'
S 01°37'48" W 204.83'
S 01°37'48" W 204.83'
S 01°37'48" W 204.83

© SGA ENGINEERING PLLC – DATE PLOTTED: Apr. 02, 2026 – 2:14 PM SGA DRAWING FILE: W:\DWG\2451– PARKLANDS II\STORMWATER\DWGS\DEVELOPED BASIN MAP – ORIGINAL PARKLANDS TH AREA.DWG

PREVIOUSLY APPROVED PARKLANDS AT CAMAS MEADOWS SITE BASIN	
	Acres
PGHS	2.91
PGPS	0.34
NPGHS	0.00
NPGPS	0.00
Total	3.25

'PREVIOUSLY ANALYZED PARKLANDS AT CAMAS MEADOWS SITE BASIN'

177 LF OF TEMP. GRAVEL SCREENINGS TRAIL TO BE INSTALLED WITH PHASE 1R. 177 LF OF SIDEWALK TO BE INSTALLED WITH FUTURE BP 2 CONSTRUCTION

212 LF OF SIDEWALK TO BE CONSTRUCTED WITH PHASE 1R SUBDIVISION

NW PITTOCK PL (PRIVATE)

NW MCMAS (PRIVATE)

10' ACCESS & UTILITY EASEMENT

OLIVA 175977000

CHLOE INVESTMENTS 170

BP LOT #1

BP LOT #2

FUTURE EXTENSION NW CAMAS MEADOWS DR

FF 196.50 · FF 204.50 · FF 207.50 · FF 199.00 · FF 207.25 · FF 215.00 · FF 199.75 · FF 195.50 · FF 208.75 · FF 204.50

-N-

0 40 80 120

Scale: 1" = 40'

SGA ENGINEERING & DESIGN
CIVIL ENGINEERING ~ LAND PLANNING
DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE

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VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PROFESSIONAL ENGINEER – JOHN A. INVERNIZZI – 19605 – REGISTERED – NON-TRANSFERABLE – NOT VALID WITHOUT ORIGINAL SIGNATURE AND SEAL

DEVELOPED BASIN MAP

PARKLANDS II SHORT PLAT

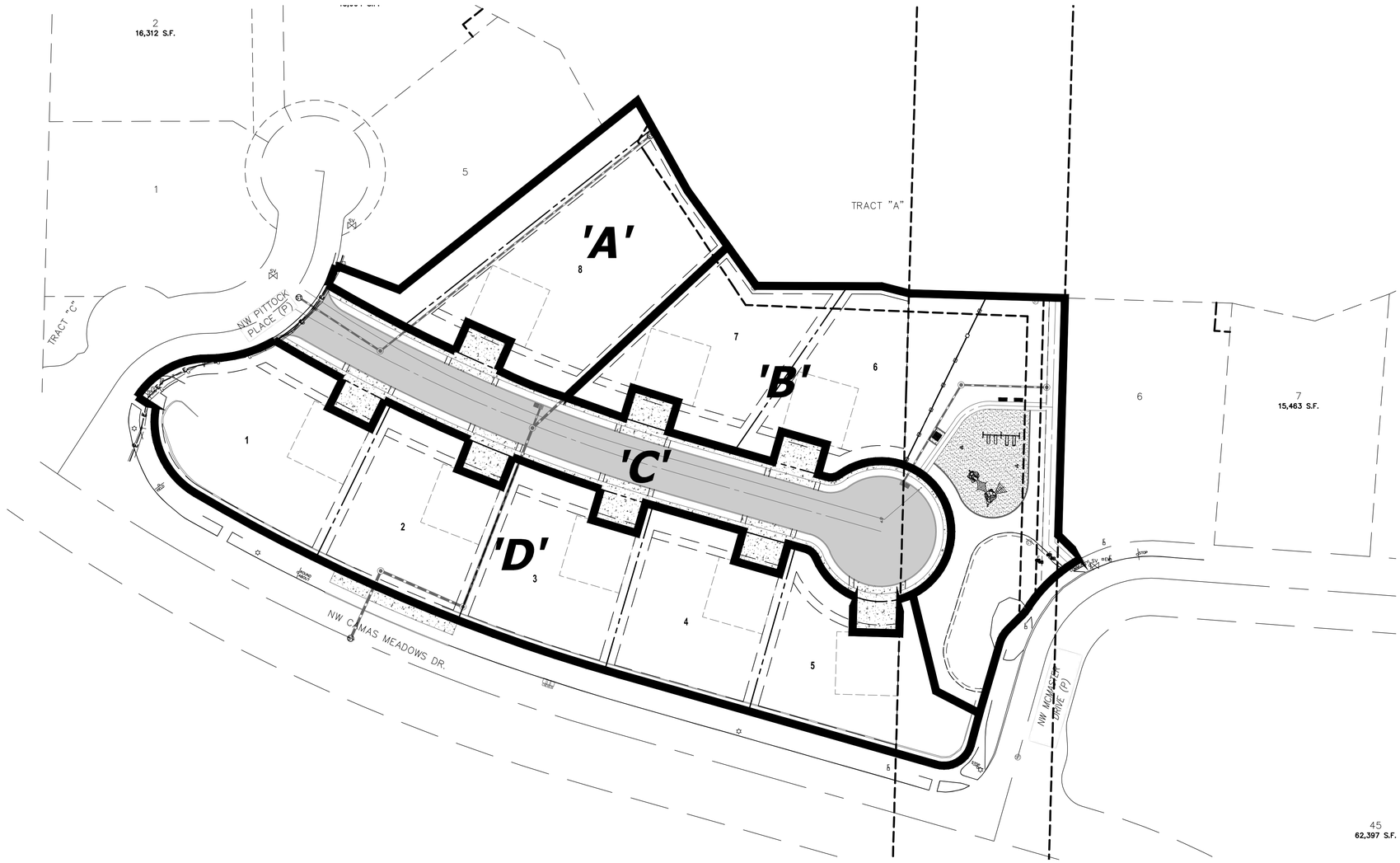
CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 40'

JOB NUMBER	SHEET
2451	DEV

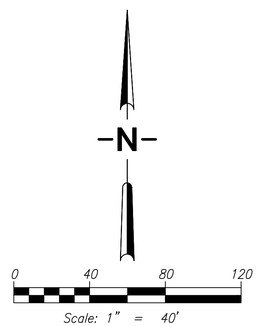


DEVELOPED A	
	Acres
PGHS	0.00
PGPS	0.00
NPGHS	0.19
NPGPS	0.29
Total	0.48

DEVELOPED B	
	Acres
PGHS	0.00
PGPS	0.00
NPGHS	0.47
NPGPS	0.44
Total	0.91

DEVELOPED C	
	Acres
PGHS	0.58
PGPS	0.07
NPGHS	0.00
NPGPS	0.00
Total	0.65

DEVELOPED D	
	Acres
PGHS	0.64
PGPS	0.57
NPGHS	0.00
NPGPS	0.00
Total	1.22



Scale: 1" = 40'

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PHONE (360)993-0911
FAX (360)993-0912

PROFESSIONAL ENGINEER — JOHN A. INVERNIZZI — STATE OF WASHINGTON — 19805 — REGISTERED

PARKLANDS II
SHORT PLAT

DEVELOPED BASIN MAP

CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 40'

JOB NUMBER 2451 | SHEET DEV

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EXHIBIT 20

THE ARCHERY BUSINESS PARK SITE SUMMARY DATA SUMMARY						
THE ARCHERY BP PHASE LOT AREA (SF)	BP PHASE #	BUILDING #	DIMENSIONS	FOOT PRINT AREA UP TO (SF)	ADDITIONAL POSSIBLE 2ND FLOOR AREA UP TO (SF)	POSSIBLE # OF STORIES OR DESCRIPTION
8,015	1	N/A	N/A	N/A	N/A	BP 1 ROW
24,700	1	1	50'x60	3,000	3,000	1
117,646	2A	2A	90'x220'	19,800	19,800	BP ON LEVELS 1 & 2
15,480	2A	N/A	N/A	N/A	N/A	BP 2 BUFFER
7,248	2A	N/A	N/A	N/A	N/A	BP 2 ROW
62,710	3	3	VARIES	20,000 MIN	20,000	1+ LOWER PARKING
127,653	4	4A	100'x135'	15,000	15,000	1
	4	4B	100'x160'	16,000	16,000	1
363,452 (8.34 AC)			TOTALS:	73,800	73,800	
ARCHERY UNITS	2B	2B	90'x220'	19,800	UP TO 59,400	UNITS ON LEVELS 3,4,5

ARCHERY LIVING UNITS ON BLDG 2B UPPER LEVELS 3,4,5 PLUS DAYLIGHT BASEMENT SECURED PARKING GARAGE.
ANY RESIDENTIAL UNITS IN THE BP TO AREA ALSO MEET REQUIREMENTS OF THE MASTER PLAN.

PARKING REQUIREMENTS PER MASTER PLAN.
GENERAL OFFICE = 1 SPACE PER 400 SQUARE FEET OF GROSS FLOOR AREA
REQUIRED PARKING = 254 SPACES. 498 TOTAL SPACES PROVIDED.
AVAILABLE PARKING TO BE PROVIDED TO MEET OR EXCEED REQUIREMENT IN FINAL SITE PLAN. RECIPROCAL PARKING USE AGREEMENTS BETWEEN PHASES AND BUILDING 3 AND 4 TO BE ESTABLISHED.
NET AVAILABLE BP AREA: 8.34 AC = 53% OF ORIGINAL PARCEL AREA
1–EXISTING PARCEL # 175948000 15.70 ACRES ZONED BP
2–EXISTING PARCEL # 986031650 20.98 ACRES ZONED R–15
3–EXISTING CITY ROW 2.5 ACRES AT 74 FT WIDE

RESIDENTIAL PHASING OF SINGLE FAMILY DETACHED:
PHASE 1R – AS SHOWN
PHASE 2R – MINIMUM OF 9 LOTS
PHASE 3R – MINIMUM OF 9 LOTS
NOTE: PHASE 2R & 3R CANNOT PULL HOUSE BUILDING PERMIT UNTIL AGREED TO BP PHASE IS STARTED PER MASTER PLAN.
ACCESSORY DWELLING UNITS (ADU) TO BE ALLOWED ON ALL RESIDENTIAL LOTS & ENCOURAGED IN RESIDENTIAL CCRS & HOA.

DEVELOPER & APPLICANT:
PARKLANDS AT CAMAS MEADOWS LLC
KEVIN DEFORD 360–823–6222 ngdelopment@gmail.com
AARON BARR 503–319–4021 abarrmail@gmail.com
20705 SE EVERGREEN HWY CAMAS, WA 98607

FOR ALL LOTS WITH ACCESS EASEMENTS NOTE:
PER TABLE 17.19.040–1 FOOT NOTE 2, SHARED ACCESS TO 1 OR 2 LOTS = 20' WIDE PRIVATE EASEMENT WITH 12'–20' PAVED, NO PARKING AND ALL LOTS SPRINKLERED.

BOUNDARIES:
BOUNDARIES ARE BASED ON SURVEY FROM MGS AND WETLAND BOUNDARY FROM ECOLOGICAL LAND SERVICES,INC. FINAL BOUNDARIES AND LOT LINES MAY CHANGE SLIGHTLY PRIOR TO FINAL ENGINEERING AND FINAL PLAT.

PRELIMINARY PLAT AND BINDING SITE PLAN:
REFER TO MASTER PLAN AND DEVELOPMENT AGREEMENT D.A. FOR PROJECT SPECIFIC RESIDENTIAL AND BUSINESS PARK DEVELOPMENT STANDARDS TABLE.

PRIVATE STREET PER PVT2
30' PRIVATE R/W
20' PAVED ROAD WITH CURB AND GUTTER
NO PARKING BOTH SIDES
5' ATTACHED SIDEWALK WEST SIDE
CENTERLINE 240 LF
NW PARKLANDS TRAIL DR ASPHALT PAVING = 4,927 SF
PER TABLE 17.19.040–1–B TO MINIMIZE BUFFER IMPACTS, MINIMIZE STREET WIDTH & ATTACH SIDEWALK, ALL LOTS SPRINKLERED AS > 100' IN LENGTH.

PRIVATE STREET PER PVT3
42' PRIVATE TRACT R/W
28' PAVED ROAD WITH CURB AND GUTTER
5' DETACHED SIDEWALK ONE SIDE
NW 10TH FAIRWAY DR ASPHALT PAVING = 11,151 SF
NW PARKLANDS TRAIL DR ASPHALT PAVING = 6,541 SF
NW 17TH GREEN DR ASPHALT PAVING = 10,815 SF
NO PARKING ONE SIDE

PRIVATE STREET PER PVT4
48' PRIVATE R/W
28' PAVED ROAD WITH CURB AND GUTTER
5' PLANTER BOTH SIDES
5' DETACHED SIDEWALK BOTH SIDES
CENTERLINE 1480 LF
NW 16TH FAIRWAY CT ASPHALT PAVING = 11,194 SF
NW GOLF DR ASPHALT PAVING = 28,860 SF

ALL CUL–DE–SAC TURNAROUNDS PER ST36 FOR SPRINKLERED DEVELOPMENT WITH 30' PAVED & 5' ATTACHED SIDEWALK WITH OUTER SIDEWALK TURNAROUND RADIUS BULB = 35'
35' RADIUS CUL–DE–SAC BULB
30' PAVED CUL–DE–SAC BULB

EXISTING CONDITION NOTES:
NO EXISTING STRUCTURES ONSITE.
EXISTING FIRE HYDRANT LOCATION:
200' WEST OF SITE ON NW CAMAS MEADOWS DR.
375' SOUTH OF SITE ON NW LAKESPUR ST.

GRADING NOTES:
SEE THE GRADING PLAN FOR PROPOSED ONSITE GRADING.

STREET NOTES:
STREET LIGHTS AND STREET TREES TO BE DESIGNED BY OTHERS PRIOR TO FINAL PLAT.

◇ STREET LIGHTS
▬ PROPOSED ENTRY SIGN LOCATIONS
▪ TRAIL ACCESS SIGNAGE

GRAPHIC SCALE 1"=60'
0 60 120

KESSI ENGINEERING
CONSULTING PLANNING CIVIL ENGINEERING PROJECT MANAGEMENT
6400 NE HWY 99 #G–169
VANCOUVER, WA 98665
Tel: (360) 991–9300
www.kessiconsulting.com

DATE: 07 DEC 2015

PARKLANDS EXECUTIVE SUBDIVISION AND THE ARCHERY BUSINESS PARK SITE PLAN AT CAMAS MEADOWS GOLF COURSE
PRELIMINARY PLAT & SITE PLAN WITH MASTER PLAN

SHEET 1

This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.

BK 311 PG 924

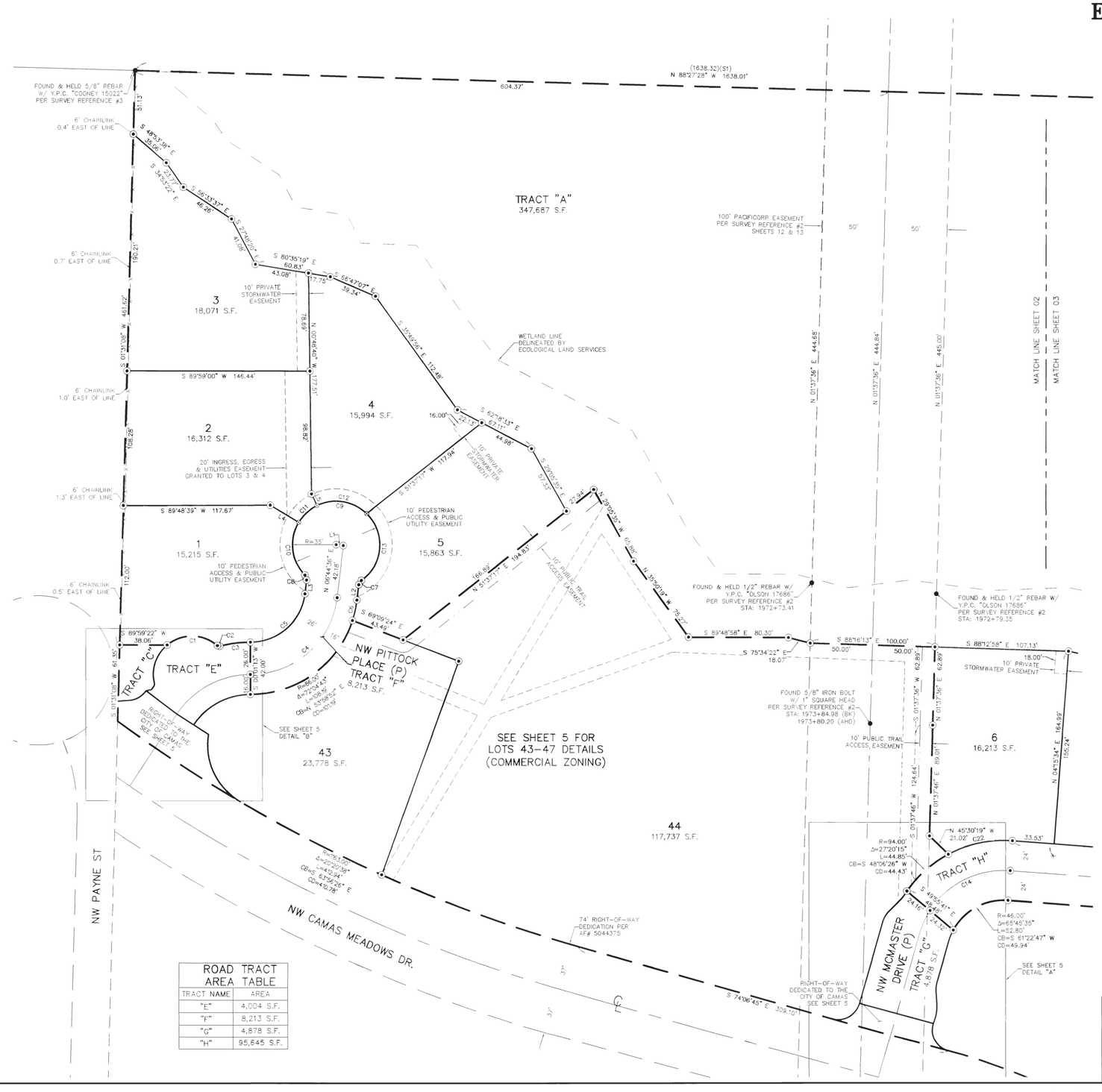
ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 2 OF 6

CURVE TABLE SHEETS 2–4					
CURVE	RADIUS	DELTA	ARC DIST.	CHORD BEARING	CHORD DIST.
C1	31.00'	80°48'31"	43.72'	N 89°26'32" W	40.19'
C2	2.00'	55°47'04"	1.95'	S 76°55'49" E	1.87'
C3	96.00'	14°50'35"	24.87'	S 82°35'56" W	24.80'
C4	70.00'	83°16'37"	101.74'	N 48°22'55" E	93.02'
C5	44.00'	83°16'37"	63.95'	N 48°22'55" E	58.47'
C6	86.00'	11°11'55"	16.81'	N 12°20'33" E	16.78'
C7	5.00'	47°58'14"	4.19'	S 30°43'43" W	4.07'
C8	5.00'	50°54'50"	4.44'	N 18°42'49" W	4.30'
C9	35.00'	278°53'04"	170.36'	N 84°43'42" W	45.52'
C10	35.00'	75°06'12"	45.88'	S 06°37'08" E	42.66'
C11	35.00'	33°12'11"	20.28'	S 47°32'04" W	20.00'
C12	35.00'	70°05'45"	42.82'	N 80°48'58" W	40.20'
C13	35.00'	100°28'55"	61.38'	N 04°28'22" E	53.81'
C14	70.00'	61°45'45"	75.46'	S 63°22'42" W	71.86'
C15	70.00'	15°29'29"	18.93'	N 77°59'42" W	18.87'
C16	70.00'	71°33'54"	87.43'	N 34°28'00" W	81.86'
C17	100.00'	3°49'07"	6.66'	N 17°50'29" E	6.66'
C18	70.00'	11°06'06"	13.56'	N 10°22'52" E	13.54'
C19	70.00'	22°35'32"	27.60'	N 06°27'57" W	27.42'
C20	70.00'	20°06'55"	24.58'	S 07°42'16" E	24.45'
C21	35.00'	89°09'49"	54.47'	S 46°56'06" W	49.13'
C22	94.00'	32°29'00"	53.29'	S 78°01'03" W	52.58'
C23	46.00'	15°29'29"	12.44'	N 77°59'42" W	12.40'
C24	94.00'	13°34'37"	22.27'	N 78°57'07" W	22.22'
C25	25.00'	88°05'09"	38.43'	N 63°47'37" E	34.76'
C26	25.00'	90°00'00"	39.27'	S 25°14'57" E	35.36'
C27	46.00'	71°33'54"	57.46'	N 34°28'00" W	53.79'
C28	94.00'	71°33'56"	117.41'	N 34°28'00" W	109.93'
C29	94.00'	8°34'43"	14.07'	N 65°57'36" W	14.06'
C30	94.00'	34°32'25"	56.67'	N 44°24'02" W	55.81'
C31	94.00'	13°05'07"	21.47'	N 20°35'16" W	21.42'
C32	94.00'	15°21'40"	25.20'	N 06°21'52" W	25.13'
C33	10.00'	40°49'14"	7.12'	S 19°05'40" E	6.97'
C34	10.00'	41°01'53"	7.16'	N 21°49'53" E	7.01'
C35	35.00'	261°51'07"	159.96'	S 88°34'44" E	52.89'
C36	35.00'	67°38'20"	41.32'	N 05°41'07" W	38.96'
C37	35.00'	34°38'19"	21.16'	N 45°27'13" E	20.84'
C38	35.00'	53°04'46"	32.42'	N 89°18'46" E	31.28'
C39	35.00'	34°52'34"	21.30'	S 46°42'35" E	20.98'
C40	35.00'	71°37'08"	43.75'	S 06°32'16" W	40.96'
C41	74.00'	3°49'07"	4.93'	N 17°50'29" E	4.93'
C42	116.00'	3°49'07"	7.73'	N 17°50'29" E	7.73'
C43	70.00'	11°06'06"	13.56'	N 10°22'52" E	13.54'
C44	85.00'	11°06'06"	16.47'	N 10°22'52" E	16.44'
C45	50.00'	22°35'32"	19.72'	N 06°27'57" W	19.59'
C46	84.00'	22°35'32"	33.12'	N 06°27'57" W	32.91'
C47	90.00'	20°06'55"	31.60'	S 07°42'16" E	31.43'
C48	56.00'	20°06'55"	19.66'	S 07°42'16" E	19.56'
C49	70.00'	89°09'49"	108.93'	S 46°56'06" W	98.27'
C50	20.00'	89°09'49"	31.12'	S 46°56'06" W	28.08'
C51	70.00'	19°22'58"	23.68'	S 12°02'41" W	23.57'
C52	70.00'	22°12'38"	27.14'	S 32°50'28" W	26.97'
C53	70.00'	47°34'13"	58.12'	S 67°43'54" W	56.46'
C54	5.00'	72°32'33"	6.33'	N 52°12'44" W	5.92'
C55	35.00'	252°32'33"	154.27'	N 37°47'16" E	56.44'
C56	35.00'	96°03'16"	58.68'	S 63°58'05" E	52.04'
C57	35.00'	37°14'17"	22.75'	N 49°23'08" E	22.35'
C58	35.00'	46°31'43"	28.42'	N 07°30'08" E	27.65'
C59	35.00'	34°56'47"	21.35'	N 33°14'07" W	21.02'
C60	35.00'	37°46'30"	23.08'	N 69°35'45" W	22.66'
C61	85.00'	1°57'15"	2.90'	N 14°57'18" E	2.90'
C62	85.00'	9°08'51"	13.57'	N 09°24'15" E	13.56'

LINE TABLE SHEETS 2–4		
LINE	BEARING	DISTANCE
L1	S 83°15'24" E	5.78'
L2	N 06°44'36" E	12.46'
L3	S 06°44'36" W	11.13'
L4	N 59°04'02" W	26.51'
L5	S 25°51'51" E	10.23'
L6	N 17°45'43" W	36.12'
L7	N 02°21'12" E	17.47'
L8	S 01°31'00" W	9.00'

ROAD TRACT AREA TABLE	
TRACT NAME	AREA
"E"	4,004 S.F.
"F"	8,213 S.F.
"G"	4,878 S.F.
"H"	95,645 S.F.



SURVEY REFERENCES:

1) SURVEY BOOK 49, PAGE 186
2) SURVEY BOOK 51, PAGE 161
3) SURVEY BOOK 49, PAGE 167
4) "LACAMAS SHORES – PHASE 6C" SUBDIVISION BOOK J, PAGE 531
5) "LACAMAS SHORES – PHASE 6D" SUBDIVISION BOOK J, PAGE 559
6) "LACAMAS ESTATES" SUBDIVISION BOOK 311, PAGE 414
7) "LARKSPUR ESTATES PH. 1" SUBDIVISION BOOK 311, PAGE 358
8) "LARKSPUR ESTATES PH. 2" SUBDIVISION BOOK 311, PAGE 401
9) SURVEY BOOK 53, PAGE 111
10) SURVEY BOOK 54, PAGE 024

DEED REFERENCE:

GRANTOR: CHINOOK LANDOWNWERS GROUP OF VANCOUVER, WASHINGTON, L.L.C.
GRANTEE: ESTATES AT PARKLANDS LLC
AFN: 5408391
DATE: MAY 31, 2017

LEGEND:

- ● INDICATES MONUMENT FOUND AS NOTED
- ⊙ INDICATES 1/2" x 24" REBAR WITH YELLOW PLASTIC CAP INSCRIBED "RENTON 37535", SET
- ⊗ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535", SET
- \+ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535" SET AS A WITNESS CORNER AT THE EXTENSION OF LOT LINE IN THE CURB
- ○ INDICATES CALCULATED POSITION NOTHING SET

BASIS OF BEARINGS: NAD83(2011)(EPOCH:2010.0000), WASHINGTON STATE PLANE COORDINATE SYSTEM SOUTH ZONE, U.S. SURVEY FEET

10/31/17

DANIEL ADOLPH RENTON — STATE OF WASHINGTON — 37535 — REGISTERED PROFESSIONAL LAND SURVEYOR

40 20 0 40 60 80
SCALE 1 INCH = 40 FEET

MINISTER–GLAESER SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694–3313

JOB NO. 15-185
DATE: 10-31-17
CALC BY: DLS
DRAWN BY: CSA
CHECKED BY: DAR
FILE: 15185.DWG

BK 311 PG 924

2/6

Design Criteria Appendix B

WWHM Soil Groups

Memorandum

otak

700 Washington Street
Suite 401.
Vancouver, WA 98660
Phone (360) 737-9613
Fax (360) 737-9651

To: Rod Swanson, Clark County Environmental Services

From: Tim Kraft

Copies: File

Date: December 21, 2010

Subject: Clark County WWHM Soil Groupings

The Clark County version of the Western Washington Hydrology Model (WWHM) includes five soils groups to represent the many soil types found within the county limits. Although there are over 110 different soil types throughout Clark County, similarities between the soils allows them to be grouped into categories for modeling purposes.

Clark County soils are grouped into five categories largely based on their permeability and runoff potential. These categories include:

- Soil Group (SG) 1 – Excessively drained soils (hydrologic soil groups A & B)
- Soil Group (SG) 2 – Well drained soils (mostly hydrologic soil group B)
- Soil Group (SG) 3 – Moderately drained soils (hydrologic soil groups B & C)
- Soil Group (SG) 4 – Poorly drained soils (slowly infiltrating C soils, as well as D soils)
- Soil Group (SG) 5 – Wetland soils (mucks).

Soil Groups 1 and 2 are those most suitable for traditional infiltration facilities such as trenches and drywells, while Soil Group 3 may only be suitable for slower infiltrating facilities such as rain gardens and other Low Impact Development (LID) measures. Soil Groups 4 and 5 are those which are typically not suitable for infiltration.

For additional information on the classification of soils for use in the Clark County WWHM model, please see the report titled "Development of the Clark County Version of the Western Washington Hydrology Model", which can be found on the county's community development web site.

The following table lists the WWHM soil group for each NCRS soil type in Clark County.

Map Symbol	Soil Name	HSG
Soils Group (SG) 1		
LeB	LAUREN	B
LgB	LAUREN	B
LgD	LAUREN	B
LgF	LAUREN	B
LIB	LAUREN	B
Ro	ROUGH BROKEN LAND	A
SvA	SIFTON	B
WnB	WIND RIVER VARIANT	B
WnD	WIND RIVER VARIANT	B
WnG	WIND RIVER VARIANT	B
WrB	WIND RIVER VARIANT	B
WrF	WIND RIVER VARIANT	B
	PITS	A
	BONNEVILLE STONY SAND LOAM	A
Soils Group (SG) 2		
BpB	BEAR PRARIE	B
BpC	BEAR PRARIE	B
CnB	CINEBAR	B
CnD	CINEBAR	B
CnE	CINEBAR	B
CnG	CINEBAR	B
CrE	CINEBAR	B
CrG	CINEBAR	B
CsF	CISPUS	B
CtA	CLOQUATO	B
HlA	HILLSBORO	B
HlB	HILLSBORO	B
HlC	HILLSBORO	B
HlD	HILLSBORO	B
HlE	HILLSBORO	B

Map Symbol	Soil Name	HSG
HlF	HILLSBORO	B
Soils Group (SG) 2 (continued)		
KeC	KINNEY	B
KeE	KINNEY	B
KeF	KINNEY	B
KnF	KINNEY	B
LaE	LARCHMOUNT	B
LaG	LARCHMOUNT	B
LcG	LARCHMOUNT	B
MsB	MOSSYROCK	B
NbA	NEWBERG	B
NbB	NEWBERG	B
PhB	PILCHUCK	C
PuA	PUYALLUP	B
SaC	SALKUM	B
VaB	VADER	B
VaC	VADER	B
WaA	WASHOUGAL	B
WgB	WASHOUGAL	B
WgE	WASHOUGAL	B
WhF	WASHOUGAL	B
YaA	YACOLT	B
YaC	YACOLT	B
YcB	YACOLT	B

Soils Group (SG) 3

DoB	DOLLAR	C
HcB	HESSON	C
HcD	HESSON	C
HcE	HESSON	C
HcF	HESSON	C
HgB	HESSON	C
HgD	HESSON	C
HhE	HESSON	C
HoA	HILLSBORO	B

Map Symbol	Soil Name	HSG
HoB	HILLSBORO	B
Soils Group (SG) 3 (continued)		
HoC	HILLSBORO	B
HoD	HILLSBORO	B
HoE	HILLSBORO	B
HoG	HILLSBORO	B
HsB	HILLSBORO	B
McB	McBEE	C
MeA	McBEE	C
MIA	McBEE	C
OeD	OLEQUA	B
OeE	OLEQUA	B
OeF	OLEQUA	B
OlB	OLYMPIC	B
OID	OLYMPIC	B
OlE	OLYMPIC	B
OIF	OLYMPIC	B
OmE	OLYMPIC	B
OmF	OLYMPIC	B
OpC	OLYMPIC VARIANT	C
OpE	OLYMPIC VARIANT	C
OpG	OLYMPIC VARIANT	C
OrC	OLYMPIC VARIANT	C
PoB	POWELL	C
PoD	POWELL	C
PoE	POWELL	C
SmA	SAUVIE	B
SmB	SAUVIE	B
SnA	SAUVIE	D
SpB	SAUVIE	B

Soils Group (SG) 4

CvA	COVE	D
CwA	COVE	D
GeB	GEE	C

Map Symbol	Soil Name	HSG
GeD	GEE	C
Soils Group (SG) 4 (continued)		
GeE	GEE	C
GeF	GEE	C
GuB	GUMBOOT	D
HtA	HOCKINSON	D
HuB	HOCKINSON	D
HvA	HOCKINSON	D
LrC	LAUREN	C
LrF	LAUREN	C
MnA	MINNIECE	D
MnD	MINNIECE	D
MoA	MINNIECE VARIANT	D
OdB	ODNE	D
OhD	OLEQUA VARIANT	C
OhF	OLEQUA VARIANT	C
SlB	SARA	D
SlD	SARA	D
SlF	SARA	D
Soils Group (SG) 5		
Sr	SEMIAHMOO	C
Su	SEMIAHMOO VARIANT	D
ThA	TISCH	D

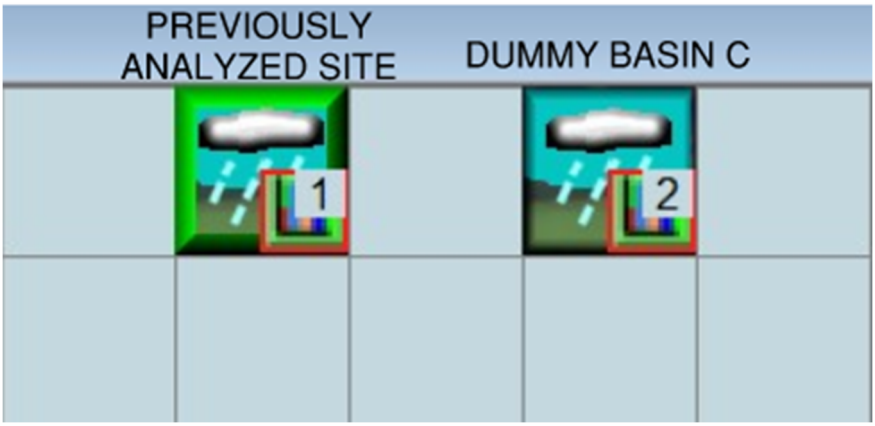
Hydraulic Calculations Appendix C

Water Quality Design

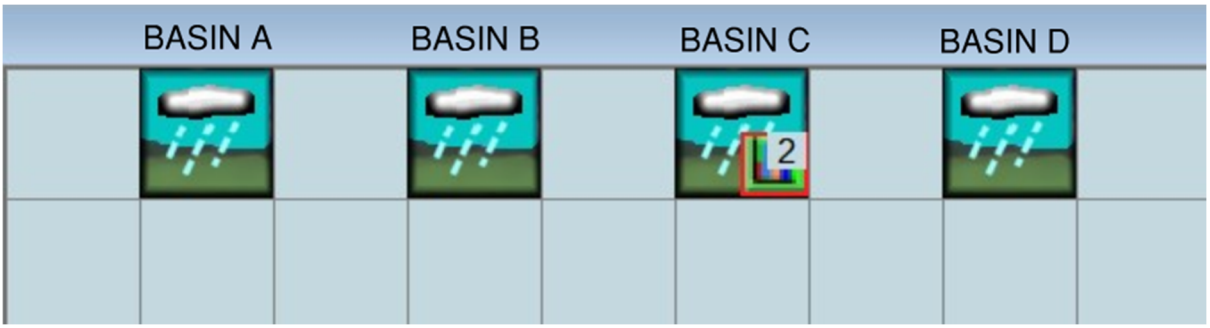
Western Washington Hydrology Model (WWHM) Project Report

WWHM SCHEMATIC

Predeveloped:



Mitigated:

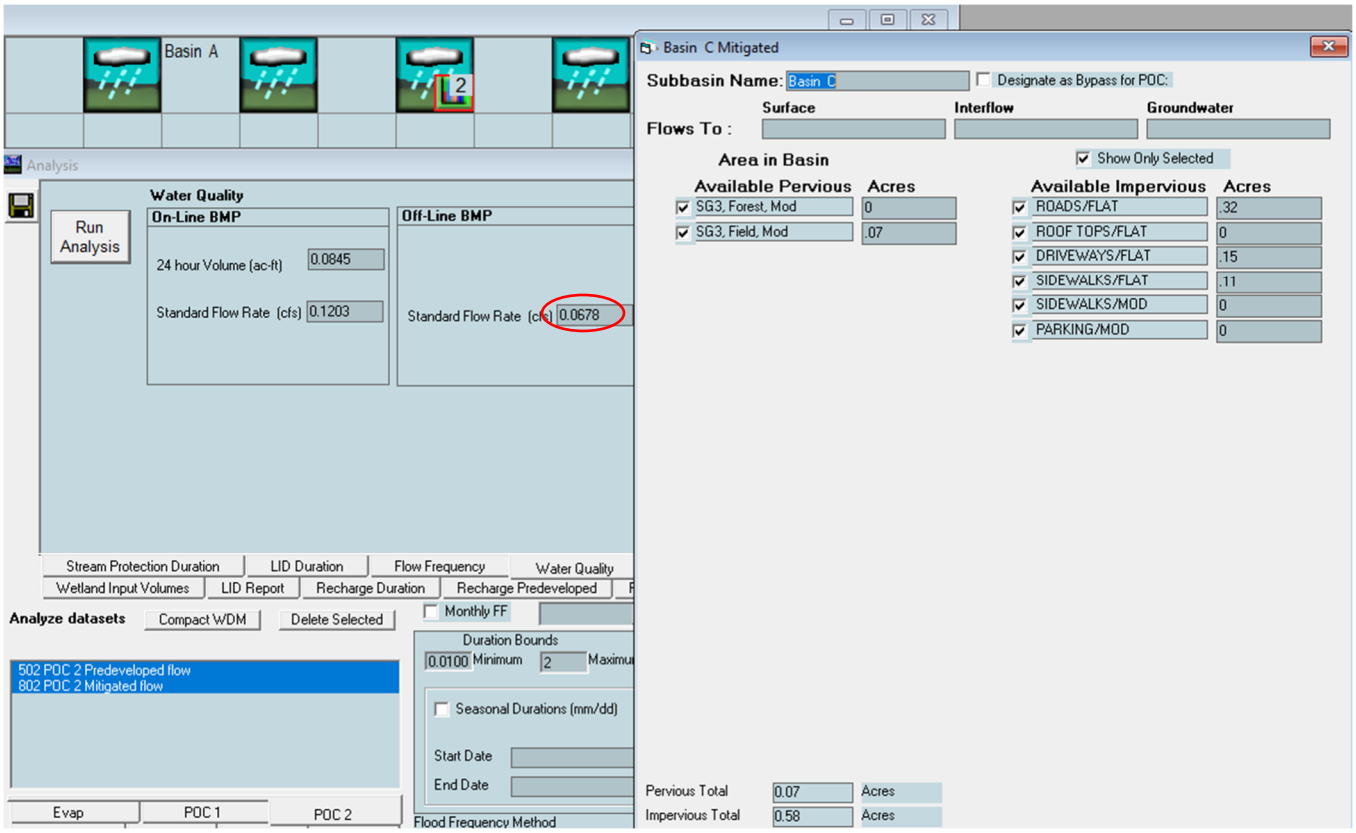


Water Quality

BASIN C:

WQ = 0.0678 CFS ~ (2) 27" PHOSPHOSORB CARTRIDGE

(2*0.0420 = 0.0840 CFS CAPACITY)



WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Previously Analyzed Site

Site Name:	Parklands II
Site Address:	3711 NW Camas Meadows Dr
City:	Camas
Report Date:	3/23/2026
Gage:	Lacamas
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	1.300
Version Date:	2024/06/28
Version:	4.3.1

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Previously Analyzed Site

Bypass: No

GroundWater: No

Pervious Land Use	acre
SG3, Forest, Mod	0.33
Pervious Total	0.33

Impervious Land Use	acre
PARKING MOD	2.92
Impervious Total	2.92
Basin Total	3.25

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Basin A

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.29
Pervious Total	0.29

Impervious Land Use	acre
ROOF TOPS FLAT	0.19
Impervious Total	0.19
Basin Total	0.48

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

POC 1	POC 1	

Basin B

Bypass: No

GroundWater: No

Pervious Land Use	acre
SG3, Field, Mod	0.44
Pervious Total	0.44

Impervious Land Use	acre
ROADS FLAT	0.17
ROOF TOPS FLAT	0.26
SIDEWALKS FLAT	0.04
Impervious Total	0.47
Basin Total	0.91

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Basin C

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.07
Pervious Total	0.07

Impervious Land Use	acre
ROADS FLAT	0.32
DRIVEWAYS FLAT	0.15
SIDEWALKS FLAT	0.11
Impervious Total	0.58
Basin Total	0.65

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Basin 4

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.58
Pervious Total	0.58

Impervious Land Use	acre
ROOF TOPS FLAT	0.64
Impervious Total	0.64
Basin Total	1.22

Element Flow Componants:

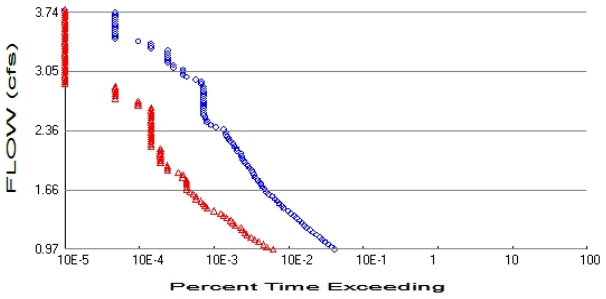
Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

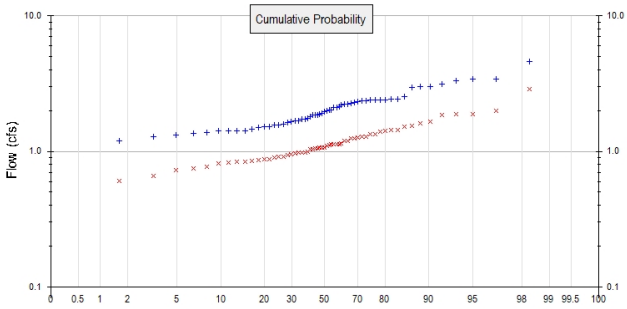
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.33
Total Impervious Area: 2.92

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.38
Total Impervious Area: 1.88

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.94387
5 year	2.516003
10 year	2.895756
25 year	3.378837
50 year	3.742024
100 year	4.108653

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.082781
5 year	1.413891
10 year	1.644682
25 year	1.950124
50 year	2.188058
100 year	2.435161

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	2.961	1.606
1950	1.565	0.864
1951	1.654	1.131
1952	1.861	0.972
1953	1.556	0.946
1954	2.387	1.446
1955	2.217	0.915
1956	2.116	1.187
1957	1.981	1.195
1958	2.412	1.245

1959	1.420	0.843
1960	1.635	0.834
1961	1.760	1.069
1962	1.426	0.877
1963	1.670	1.056
1964	1.590	0.810
1965	1.423	0.845
1966	2.013	0.983
1967	1.884	1.045
1968	3.310	1.863
1969	3.127	1.665
1970	3.393	2.891
1971	1.732	0.985
1972	2.986	1.338
1973	2.021	1.121
1974	1.520	1.044
1975	1.287	0.752
1976	1.458	0.944
1977	1.191	0.608
1978	2.439	1.413
1979	2.292	1.392
1980	1.313	0.773
1981	1.796	1.287
1982	1.846	1.129
1983	2.244	1.527
1984	1.360	0.658
1985	1.419	0.824
1986	2.527	1.256
1987	1.672	0.910
1988	1.902	0.982
1989	2.391	1.280
1990	2.261	1.141
1991	2.377	1.112
1992	1.858	1.061
1993	2.343	1.332
1994	2.152	0.996
1995	1.972	1.030
1996	2.357	1.542
1997	2.988	1.978
1998	3.429	1.893
1999	1.384	0.905
2000	1.495	0.724
2001	0.959	0.573
2002	2.195	1.430
2003	1.725	1.063
2004	2.106	1.096
2005	2.410	1.247
2006	2.393	1.123
2007	1.511	0.875
2008	4.579	1.868

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	4.5786	2.8914
2	3.4295	1.9776
3	3.3934	1.8934
4	3.3103	1.8683

5	3.1271	1.8629
6	2.9876	1.6654
7	2.9857	1.6059
8	2.9613	1.5421
9	2.5271	1.5273
10	2.4391	1.4457
11	2.4124	1.4302
12	2.4104	1.4130
13	2.3929	1.3920
14	2.3911	1.3384
15	2.3873	1.3318
16	2.3773	1.2874
17	2.3566	1.2797
18	2.3430	1.2561
19	2.2922	1.2469
20	2.2614	1.2446
21	2.2435	1.1951
22	2.2175	1.1868
23	2.1950	1.1409
24	2.1520	1.1312
25	2.1163	1.1293
26	2.1059	1.1233
27	2.0211	1.1215
28	2.0133	1.1124
29	1.9809	1.0957
30	1.9718	1.0690
31	1.9023	1.0634
32	1.8844	1.0611
33	1.8607	1.0562
34	1.8583	1.0452
35	1.8463	1.0444
36	1.7963	1.0298
37	1.7599	0.9959
38	1.7316	0.9851
39	1.7250	0.9831
40	1.6724	0.9825
41	1.6696	0.9718
42	1.6540	0.9465
43	1.6352	0.9439
44	1.5895	0.9146
45	1.5653	0.9102
46	1.5556	0.9048
47	1.5196	0.8769
48	1.5108	0.8751
49	1.4952	0.8641
50	1.4578	0.8446
51	1.4260	0.8427
52	1.4227	0.8339
53	1.4204	0.8238
54	1.4194	0.8098
55	1.3839	0.7734
56	1.3596	0.7521
57	1.3128	0.7238
58	1.2869	0.6578
59	1.1915	0.6084
60	0.9586	0.5732

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.9719	867	129	14	Pass
0.9999	789	107	13	Pass
1.0279	710	97	13	Pass
1.0559	645	83	12	Pass
1.0839	590	74	12	Pass
1.1118	548	66	12	Pass
1.1398	497	58	11	Pass
1.1678	445	54	12	Pass
1.1958	404	50	12	Pass
1.2238	367	48	13	Pass
1.2517	340	40	11	Pass
1.2797	317	38	11	Pass
1.3077	294	35	11	Pass
1.3357	269	31	11	Pass
1.3637	248	28	11	Pass
1.3916	226	26	11	Pass
1.4196	206	21	10	Pass
1.4476	180	17	9	Pass
1.4756	171	16	9	Pass
1.5036	156	15	9	Pass
1.5315	147	14	9	Pass
1.5595	139	12	8	Pass
1.5875	127	12	9	Pass
1.6155	112	11	9	Pass
1.6435	106	10	9	Pass
1.6715	100	9	9	Pass
1.6994	94	9	9	Pass
1.7274	90	9	10	Pass
1.7554	85	9	10	Pass
1.7834	81	9	11	Pass
1.8114	74	8	10	Pass
1.8393	72	8	11	Pass
1.8673	69	7	10	Pass
1.8953	67	5	7	Pass
1.9233	62	5	8	Pass
1.9513	59	5	8	Pass
1.9792	55	4	7	Pass
2.0072	52	4	7	Pass
2.0352	50	4	8	Pass
2.0632	49	4	8	Pass
2.0912	48	4	8	Pass
2.1191	43	4	9	Pass
2.1471	42	4	9	Pass
2.1751	39	3	7	Pass
2.2031	38	3	7	Pass
2.2311	35	3	8	Pass
2.2590	33	3	9	Pass
2.2870	31	3	9	Pass
2.3150	30	3	10	Pass
2.3430	30	3	10	Pass
2.3710	28	3	10	Pass
2.3990	22	3	13	Pass
2.4269	19	3	15	Pass

2.4549	17	3	17	Pass
2.4829	17	3	17	Pass
2.5109	16	3	18	Pass
2.5389	15	3	20	Pass
2.5668	15	3	20	Pass
2.5948	15	3	20	Pass
2.6228	15	3	20	Pass
2.6508	15	2	13	Pass
2.6788	15	2	13	Pass
2.7067	15	2	13	Pass
2.7347	15	1	6	Pass
2.7627	15	1	6	Pass
2.7907	15	1	6	Pass
2.8187	15	1	6	Pass
2.8466	15	1	6	Pass
2.8746	15	1	6	Pass
2.9026	14	0	0	Pass
2.9306	14	0	0	Pass
2.9586	12	0	0	Pass
2.9865	9	0	0	Pass
3.0145	8	0	0	Pass
3.0425	8	0	0	Pass
3.0705	8	0	0	Pass
3.0985	6	0	0	Pass
3.1264	6	0	0	Pass
3.1544	5	0	0	Pass
3.1824	5	0	0	Pass
3.2104	5	0	0	Pass
3.2384	5	0	0	Pass
3.2664	5	0	0	Pass
3.2943	5	0	0	Pass
3.3223	3	0	0	Pass
3.3503	3	0	0	Pass
3.3783	3	0	0	Pass
3.4063	2	0	0	Pass
3.4342	1	0	0	Pass
3.4622	1	0	0	Pass
3.4902	1	0	0	Pass
3.5182	1	0	0	Pass
3.5462	1	0	0	Pass
3.5741	1	0	0	Pass
3.6021	1	0	0	Pass
3.6301	1	0	0	Pass
3.6581	1	0	0	Pass
3.6861	1	0	0	Pass
3.7140	1	0	0	Pass
3.7420	1	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

POC 2

POC #2 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

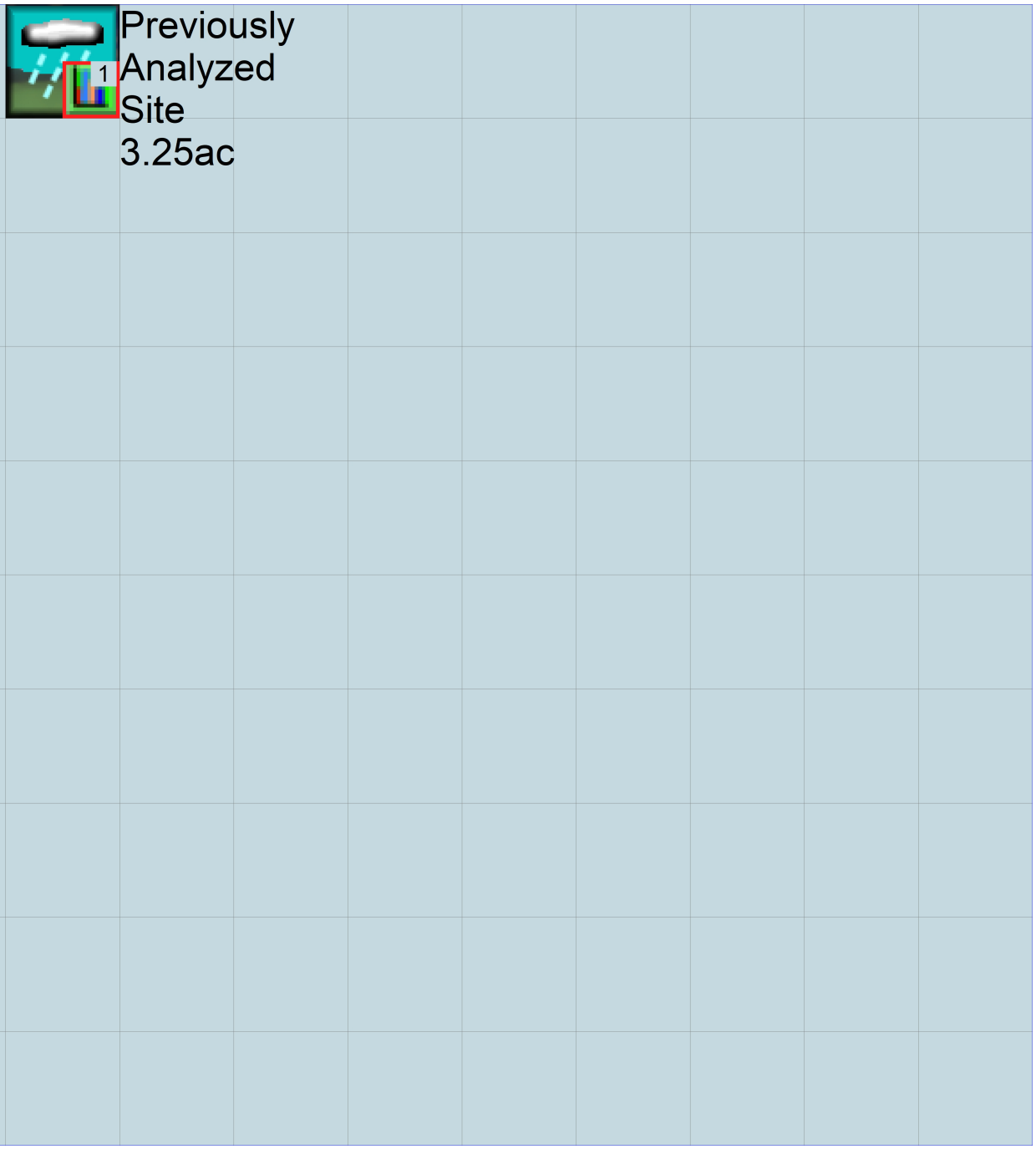
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



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   Previously Analyzed Site.wdm
MESSU       25   PrePreviously Analyzed Site.MES
            27   PrePreviously Analyzed Site.L61
            28   PrePreviously Analyzed Site.L62
            30   POCPreviously Analyzed Site1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      20
      IMPLND      12
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Previously Analyzed Site    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         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           ***
   20     SG3, Forest, Mod        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 ***
   20         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  *********
   20         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 ***
   20         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
   20             0         9      0.08       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   20              0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   20            0.2         1      0.35         4       0.4       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
   20             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   12         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   12         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   12         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   12            400      0.05       0.1      0.08
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   12              0         0
```

```
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   12              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Previously Analyzed Site***
PERLND  20                        0.33     COPY   501     12
PERLND  20                        0.33     COPY   501     13
IMPLND  12                        2.92     COPY   501     15

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-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 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***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

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   Previously Analyzed Site.wdm
MESSU       25   MitPreviously Analyzed Site.MES
            27   MitPreviously Analyzed Site.L61
            28   MitPreviously Analyzed Site.L62
            30   POCPreviously Analyzed Site1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      23
      IMPLND       4
      IMPLND       1
      IMPLND       8
      IMPLND       5
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  A                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         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           ***
   23     SG3, Field, Mod         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 ***
   23         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  *********
   23         0    0    4    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 ***
   23         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
   23              0         9      0.06       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   23              0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   23           0.15         1       0.3         4       0.4       0.4
  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
   23              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
    5         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4         0    0    0    0    0
```

```
    1         0    0    0    0    0
    8         0    0    0    0    0
    5         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    1              0         0
    8              0         0
    5              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
    1              0         0
    8              0         0
    5              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  A***
PERLND  23                       0.29     COPY   501     12
PERLND  23                       0.29     COPY   501     13
IMPLND   4                       0.19     COPY   501     15
Basin B***
PERLND  23                       0.44     COPY   501     12
PERLND  23                       0.44     COPY   501     13
IMPLND   1                       0.17     COPY   501     15
IMPLND   4                       0.26     COPY   501     15
IMPLND   8                       0.04     COPY   501     15
Basin  C***
PERLND  23                       0.07     COPY   501     12
PERLND  23                       0.07     COPY   501     13
IMPLND   1                       0.32     COPY   501     15
IMPLND   5                       0.15     COPY   501     15
IMPLND   8                       0.11     COPY   501     15
Basin  4***
PERLND  23                       0.58     COPY   501     12
PERLND  23                       0.58     COPY   501     13
IMPLND   4                       0.64     COPY   501     15

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-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***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
```

```
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Parklands II Short Plat

Site Name:	Parklands II
Site Address:	3711 NW Camas Meadows Dr
City:	Camas
Report Date:	3/23/2026
Gage:	Lacamas
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	1.300
Version Date:	2024/06/28
Version:	4.3.1

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year

Landuse Basin Data

Predeveloped Land Use

Previously Analyzed Site

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Forest, Mod	0.33
Pervious Total	0.33

Impervious Land Use	acre
PARKING MOD	2.92
Impervious Total	2.92
Basin Total	3.25

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Dummy Basin C

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.07
Pervious Total	0.07

Impervious Land Use	acre
ROADS FLAT	0.32
DRIVEWAYS FLAT	0.15
SIDEWALKS FLAT	0.11
Impervious Total	0.58
Basin Total	0.65

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 2	POC 2	

Mitigated Land Use

Basin A

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.29
Pervious Total	0.29

Impervious Land Use	acre
ROOF TOPS FLAT	0.19
Impervious Total	0.19
Basin Total	0.48

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

Basin B

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.44
Pervious Total	0.44

Impervious Land Use	acre
ROADS FLAT	0.17
ROOF TOPS FLAT	0.26
SIDEWALKS FLAT	0.04
Impervious Total	0.47
Basin Total	0.91

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

Basin C

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.07
Pervious Total	0.07

Impervious Land Use	acre
ROADS FLAT	0.32
DRIVEWAYS FLAT	0.15
SIDEWALKS FLAT	0.11
Impervious Total	0.58
Basin Total	0.65

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 2	POC 2	

Basin D

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Field, Mod	0.58
Pervious Total	0.58

Impervious Land Use	acre
ROOF TOPS FLAT	0.64
Impervious Total	0.64
Basin Total	1.22

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

Routing Elements
Predeveloped Routing

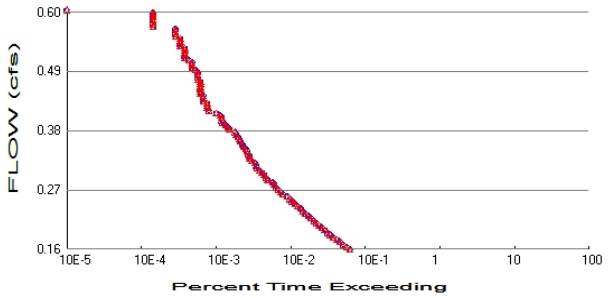
Mitigated Routing

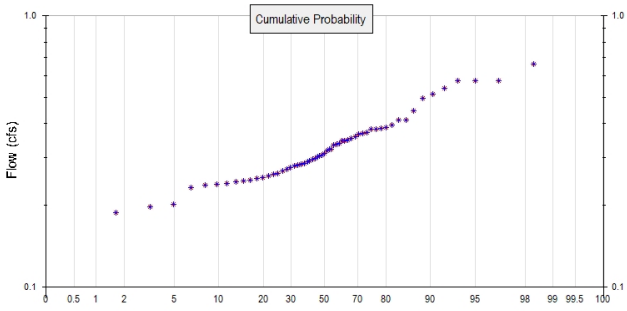
Analysis Results

POC 1

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

POC 2





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 0.07
Total Impervious Area: 0.58

Mitigated Landuse Totals for POC #2
Total Pervious Area: 0.07
Total Impervious Area: 0.58

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.315647
5 year	0.405443
10 year	0.465971
25 year	0.54397
50 year	0.603309
100 year	0.663788

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	0.315647
5 year	0.405443
10 year	0.465971
25 year	0.54397
50 year	0.603309
100 year	0.663788

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1949	0.495	0.495
1950	0.261	0.261
1951	0.286	0.286
1952	0.292	0.292
1953	0.272	0.272
1954	0.381	0.381
1955	0.282	0.282
1956	0.334	0.334
1957	0.321	0.321
1958	0.369	0.369
1959	0.260	0.260

1960	0.257	0.257
1961	0.289	0.289
1962	0.253	0.253
1963	0.310	0.310
1964	0.248	0.248
1965	0.241	0.241
1966	0.279	0.279
1967	0.297	0.297
1968	0.574	0.574
1969	0.513	0.513
1970	0.663	0.663
1971	0.304	0.304
1972	0.413	0.413
1973	0.346	0.346
1974	0.282	0.282
1975	0.232	0.232
1976	0.244	0.244
1977	0.188	0.188
1978	0.358	0.358
1979	0.414	0.414
1980	0.239	0.239
1981	0.337	0.337
1982	0.348	0.348
1983	0.381	0.381
1984	0.198	0.198
1985	0.252	0.252
1986	0.387	0.387
1987	0.238	0.238
1988	0.303	0.303
1989	0.395	0.395
1990	0.352	0.352
1991	0.321	0.321
1992	0.298	0.298
1993	0.365	0.365
1994	0.307	0.307
1995	0.317	0.317
1996	0.446	0.446
1997	0.539	0.539
1998	0.575	0.575
1999	0.247	0.247
2000	0.202	0.202
2001	0.177	0.177
2002	0.370	0.370
2003	0.275	0.275
2004	0.338	0.338
2005	0.385	0.385
2006	0.346	0.346
2007	0.267	0.267
2008	0.575	0.575

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	**Predeveloped**	**Mitigated**
1	0.6625	0.6625
2	0.5748	0.5748
3	0.5748	0.5748
4	0.5744	0.5744
5	0.5393	0.5393

6	0.5134	0.5134
7	0.4954	0.4954
8	0.4458	0.4458
9	0.4139	0.4139
10	0.4128	0.4128
11	0.3947	0.3947
12	0.3873	0.3873
13	0.3846	0.3846
14	0.3813	0.3813
15	0.3808	0.3808
16	0.3701	0.3701
17	0.3692	0.3692
18	0.3652	0.3652
19	0.3577	0.3577
20	0.3519	0.3519
21	0.3481	0.3481
22	0.3462	0.3462
23	0.3459	0.3459
24	0.3380	0.3380
25	0.3368	0.3368
26	0.3344	0.3344
27	0.3214	0.3214
28	0.3211	0.3211
29	0.3173	0.3173
30	0.3103	0.3103
31	0.3071	0.3071
32	0.3038	0.3038
33	0.3030	0.3030
34	0.2976	0.2976
35	0.2966	0.2966
36	0.2923	0.2923
37	0.2895	0.2895
38	0.2861	0.2861
39	0.2824	0.2824
40	0.2821	0.2821
41	0.2786	0.2786
42	0.2746	0.2746
43	0.2716	0.2716
44	0.2670	0.2670
45	0.2615	0.2615
46	0.2599	0.2599
47	0.2571	0.2571
48	0.2534	0.2534
49	0.2516	0.2516
50	0.2481	0.2481
51	0.2467	0.2467
52	0.2441	0.2441
53	0.2415	0.2415
54	0.2385	0.2385
55	0.2376	0.2376
56	0.2320	0.2320
57	0.2018	0.2018
58	0.1975	0.1975
59	0.1875	0.1875
60	0.1766	0.1766

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1578	1294	1294	100	Pass
0.1623	1175	1175	100	Pass
0.1668	1052	1052	100	Pass
0.1713	952	952	100	Pass
0.1758	876	876	100	Pass
0.1803	775	775	100	Pass
0.1848	711	711	100	Pass
0.1893	653	653	100	Pass
0.1938	598	598	100	Pass
0.1983	544	544	100	Pass
0.2028	502	502	100	Pass
0.2073	458	458	100	Pass
0.2118	430	430	100	Pass
0.2163	389	389	100	Pass
0.2208	363	363	100	Pass
0.2253	327	327	100	Pass
0.2298	303	303	100	Pass
0.2343	285	285	100	Pass
0.2388	258	258	100	Pass
0.2433	239	239	100	Pass
0.2478	221	221	100	Pass
0.2523	205	205	100	Pass
0.2568	187	187	100	Pass
0.2613	164	164	100	Pass
0.2658	156	156	100	Pass
0.2703	142	142	100	Pass
0.2748	135	135	100	Pass
0.2793	127	127	100	Pass
0.2838	120	120	100	Pass
0.2883	103	103	100	Pass
0.2928	98	98	100	Pass
0.2973	93	93	100	Pass
0.3018	87	87	100	Pass
0.3063	80	80	100	Pass
0.3108	75	75	100	Pass
0.3153	73	73	100	Pass
0.3198	70	70	100	Pass
0.3243	63	63	100	Pass
0.3288	59	59	100	Pass
0.3333	59	59	100	Pass
0.3378	56	56	100	Pass
0.3423	54	54	100	Pass
0.3468	52	52	100	Pass
0.3513	49	49	100	Pass
0.3558	47	47	100	Pass
0.3603	44	44	100	Pass
0.3648	43	43	100	Pass
0.3693	41	41	100	Pass
0.3738	39	39	100	Pass
0.3783	38	38	100	Pass
0.3828	32	32	100	Pass
0.3873	30	30	100	Pass
0.3918	28	28	100	Pass

0.3963	26	26	100	Pass
0.4008	25	25	100	Pass
0.4053	25	25	100	Pass
0.4098	24	24	100	Pass
0.4143	21	21	100	Pass
0.4188	17	17	100	Pass
0.4233	16	16	100	Pass
0.4278	16	16	100	Pass
0.4323	16	16	100	Pass
0.4368	14	14	100	Pass
0.4413	14	14	100	Pass
0.4458	14	14	100	Pass
0.4503	13	13	100	Pass
0.4548	13	13	100	Pass
0.4593	13	13	100	Pass
0.4638	13	13	100	Pass
0.4683	13	13	100	Pass
0.4728	13	13	100	Pass
0.4773	12	12	100	Pass
0.4818	12	12	100	Pass
0.4863	12	12	100	Pass
0.4908	12	12	100	Pass
0.4953	11	11	100	Pass
0.4998	10	10	100	Pass
0.5043	10	10	100	Pass
0.5088	10	10	100	Pass
0.5133	9	9	100	Pass
0.5178	8	8	100	Pass
0.5223	8	8	100	Pass
0.5268	8	8	100	Pass
0.5313	8	8	100	Pass
0.5358	8	8	100	Pass
0.5403	7	7	100	Pass
0.5448	7	7	100	Pass
0.5493	7	7	100	Pass
0.5538	7	7	100	Pass
0.5583	6	6	100	Pass
0.5628	6	6	100	Pass
0.5673	6	6	100	Pass
0.5718	6	6	100	Pass
0.5763	3	3	100	Pass
0.5808	3	3	100	Pass
0.5853	3	3	100	Pass
0.5898	3	3	100	Pass
0.5943	3	3	100	Pass
0.5988	3	3	100	Pass
0.6033	3	3	100	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #2

On-line facility volume:	0.0845 acre-feet
On-line facility target flow:	0.1203 cfs.
Adjusted for 15 min:	0.1203 cfs.
Off-line facility target flow:	0.0678 cfs.
Adjusted for 15 min:	0.0678 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

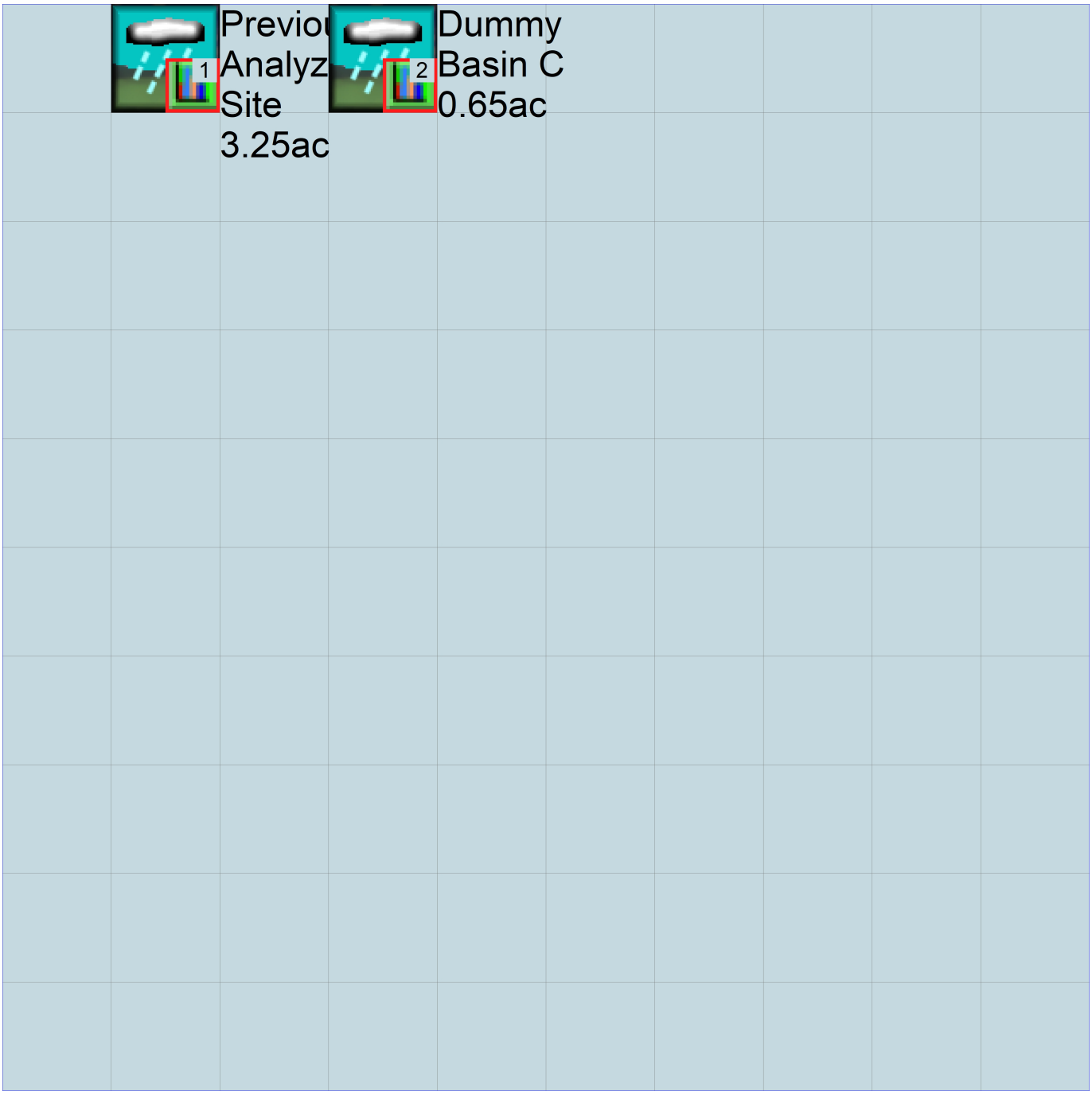
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



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   Parklands II Short Plat.wdm
MESSU       25   PreParklands II Short Plat.MES
            27   PreParklands II Short Plat.L61
            28   PreParklands II Short Plat.L62
            30   POCParklands II Short Plat1.dat
            31   POCParklands II Short Plat2.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      20
      IMPLND      12
      PERLND      23
      IMPLND       1
      IMPLND       5
      IMPLND       8
      COPY       501
      COPY       502
      DISPLY       1
      DISPLY       2
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Previously Analyzed Site    MAX                   1    2   30    9
    2        Dummy Basin C               MAX                   1    2   31    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  502         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           ***
   20     SG3, Forest, Mod        1    1    1    1   27    0
   23     SG3, Field, Mod         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 ***
   20         0    0    1    0    0    0    0    0    0    0    0    0
   23         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  *********
   20         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   23         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 ***
   20         0    0    0    0    0    0    0    0    0    0    0
   23         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
   20              0         9      0.08       400       0.1         0      0.96
   23              0         9      0.06       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   20              0         0       2.5         2         0         0         0
   23              0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   20            0.2         1      0.35         4       0.4       0.7
   23           0.15         1       0.3         4       0.4       0.4
  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
   20              0         0         0         0         3          1         0
   23              0         0         0         0         3          1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   12         0    0    1    0    0    0
    1         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   12         0    0    4    0    0    0    1    9
    1         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   12         0    0    0    0    0
    1         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   12            400      0.05       0.1      0.08
    1            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   12              0         0
    1              0         0
    5              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   12             0         0
    1             0         0
    5             0         0
    8             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Previously Analyzed Site***
PERLND  20                       0.33     COPY   501     12
PERLND  20                       0.33     COPY   501     13
IMPLND  12                       2.92     COPY   501     15
Dummy Basin C***
PERLND  23                       0.07     COPY   502     12
PERLND  23                       0.07     COPY   502     13
IMPLND   1                       0.32     COPY   502     15
IMPLND   5                       0.15     COPY   502     15
IMPLND   8                       0.11     COPY   502     15

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1
```

```
<-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***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    502 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
```

```
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

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   Parklands II Short Plat.wdm
MESSU       25   MitParklands II Short Plat.MES
            27   MitParklands II Short Plat.L61
            28   MitParklands II Short Plat.L62
            31   POCParklands II Short Plat2.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      23
      IMPLND       4
      IMPLND       1
      IMPLND       8
      IMPLND       5
      COPY       502
      DISPLY       2
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    2        Basin  C                   MAX                    1    2   31    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  502         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           ***
   23     SG3, Field, Mod         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 ***
   23         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  *********
   23         0    0    4    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 ***
   23         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
   23              0         9      0.06       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   23              0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   23           0.15         1       0.3         4       0.4       0.4
  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
   23              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
    5         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4         0    0    0    0    0
```

```
    1         0    0    0    0    0
    8         0    0    0    0    0
    5         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    1              0         0
    8              0         0
    5              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
    1              0         0
    8              0         0
    5              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  C***
PERLND  23                       0.07     COPY   502     12
PERLND  23                       0.07     COPY   502     13
IMPLND   1                       0.32     COPY   502     15
IMPLND   5                       0.15     COPY   502     15
IMPLND   8                       0.11     COPY   502     15

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1



<-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***
COPY     2 OUTPUT MEAN   1 1     48.4      WDM    702 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    802 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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Geotechnical Report Appendix D

Refer to Section G of the application packet

Geotechnical Site Investigation

Parklands at Camas Meadows

Camas, Washington

June 23, 2015

Geotechnical ■ Environmental ■ Special Inspections
Columbia West
Engineering, Inc

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



Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

GEOTECHNICAL SITE INVESTIGATION
PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

Prepared For:

Mr. Aaron Barr & Mr. Kevin Deford
Parklands at Camas Meadows, LLC
PO Box 61962
Vancouver, WA 98666

Site Location:

NE of NW Payne Street and NW Camas Meadows Drive Intersection
Parcels 175948000 and 986031650
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:

June 23, 2015

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GEOTECHNICAL SITE INVESTIGATION
PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

1.0 INTRODUCTION

Columbia West Engineering, Inc. was retained by Parklands at Camas Meadows, LLC to conduct a geotechnical site investigation for proposed development on tax parcel numbers 986031650 and 175948000 in Camas, Washington. The purpose of the investigation was to observe and assess subsurface soil conditions at specific locations and provide subsequent appropriate geotechnical engineering analyses to support property development feasibility, planning, and design recommendations. The specific scope of services was outlined in a proposal contract dated May 27, 2015. 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 northeast of the intersection of NW Payne Street and NW Camas Meadows Drive in Camas, Washington. The site is comprised of two tax parcels numbered 986031650 and 175948000 totaling approximately 36.4 acres. The regulatory jurisdictional agency is the City of Camas, Washington. The approximate latitude and longitude are N 45° 37’ 40” and W 122° 26’ 54”, and the legal description is a portion of the SW and SE ¼ of Section 28, T2N, R3E, Willamette Meridian.

1.2 Proposed Development

Review of preliminary site plans provided by the client indicates that proposed development will consist of approximately 46 residential lots and 6 commercial buildings, parking areas, loading docks, private roadways and a future extension of NW Camas Meadows Drive. Stormwater facilities and underground utilities may also be constructed as part of proposed development. Columbia West understands that cut and fill areas 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 within the central portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

According to the *Geologic Map of the Lacamas Quadrangle, Clark County, Washington* (US Geological Survey, Science Investigations Map 2924, 2006), the primary geologic unit present at the site is a Pleistocene gravel facies unit deposited by cataclysmic, glacial-outburst floods associated with Lake Missoula in Montana. However, in the areas explored during subsurface excavation, the unconsolidated boulder to cobbly gravel unit was either extremely thin or missing completely. Instead, the subsurface investigation revealed that the bulk of the site is underlain by two similar sedimentary formations. Test pit exploration indicated that the western corner of the site is underlain by an unnamed, Pleistocene to Pliocene, semi-consolidated, pebble to cobble conglomerate (QTc). This geologic unit is lithologically similar to the Pliocene or late Miocene Troutdale Formation, differing primarily in age of emplacement, degree of weathering, and the presence of hyaloclastite interbeds. Previously published geologic mapping has identified this unit as the Troutdale Formation.

The southern and eastern portion of the site is underlain by the Hyaoclastic sandstone member of the Troutdale formation (Ttfh). This Pliocene to Pleistocene formation is comprised of coarse-grained sandstone and pebble conglomerate containing basalt pebbles and cobbles. This geologic unit is lithologically similar to the Pliocene or late Miocene Troutdale Formation, differing primarily in age of emplacement, degree of weathering, and the presence of hyaloclastite interbeds. Previously published geologic mapping has identified this unit as the Troutdale Formation.

The *Web Soil Survey (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2013 Website)* indicates the site is underlain by three soil types. Hesson clay loam soils are mapped on the majority of the site from the northwest corner to the southwest corner of the property, while Cove silty clay loam and Lauren gravelly loam soils are mapped in the northern and northwestern portions of the property, respectively. Soils resembling the Lauren series were not encountered during subsurface excavation.

Although actual on-site soils may vary from the broad USDA descriptions, Lauren soils are generally coarse-textured, well drained soils with rapid permeability. Cove soils are generally fine-textured, poorly drained soils with very slow permeability and high shrink-swell potential. Hesson soils are fine-textured, well drained soils with moderately slow permeability and moderate shrink-swell potential.

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 17 miles 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 Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene aged Missoula flood deposits.

However, evidence is thought to exist which suggests that fault movement has impacted shallow Holocene deposits and deeper Pleistocene sediments. Seismologists recorded a M3.2 earthquake thought to be associated with the fault zone near Kelly Point Park in November 2012, a M3.9 earthquake thought to be associated with the fault zone near Kelly Point Park in April 2003, and a M3.5 earthquake possibly associated with the 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 possible damaging earthquakes.

Gales Creek-Newberg-Mt. Angel Fault Zone

Located approximately 35 miles 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 the fault zone forms the southwest margin of the Tualatin basin. Possible late-Quaternary 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 rocks of the Columbia River Basalts, and Miocene and Pliocene 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 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 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 Creek Fault and northeast-trending Sandy River Fault intersect north of Camas, Washington approximately 1 mile east 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 Creek fault zone consists of shear contact between the Troutdale Formation and underlying Oligocene 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 surficial deposits have been described. The Lacamas Lake 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 FIELD INVESTIGATION

A geotechnical field investigation consisting of visual reconnaissance and eight test pits (TP-1 through TP-8) was conducted at the site on June 4, 2015. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) specifications. Disturbed soil samples were collected from relevant soil horizons and submitted for laboratory analysis. Laboratory test results are presented in Appendix A. Subsurface exploration locations are indicated on Figure 2. Exploration logs are presented in Appendix B. Soil descriptions and classification information are provided in Appendix C. A photo log is provided in Appendix D.

4.1 Surface Investigation and Site Description

The approximately 36.4-acre subject site occupies two tax parcels to the east of the Camas Meadows Golf Club located at 4105 NW Camas Meadows Drive in Camas, Washington. The site was previously undeveloped and is densely vegetated with large fir and deciduous trees, associated understory vegetation, and a wetland area. The site lies at the toe of a north-facing slope near the western end of Lacamas Lake. Site elevations range from approximately 240 feet elevation in the southern portion of the site to approximately 190 feet elevation along the northern property boundary. Slope grades range from isolated short slopes of approximately 20 percent in the south central portion of the property to generally flat in the wetland area of the northern property boundary. Most slopes are gentle and range from 5 to 10 percent.

4.2 Subsurface Exploration and Investigation

Test pit explorations TP-1 through TP-8 were advanced at the site to a maximum depth of 16.5 feet using a track-mounted excavator on June 4, 2015. Subsurface exploration locations were selected to observe soil characteristics in proximity to proposed development areas and are indicated on Figure 2.

4.2.1 Soil Type Description

The field investigation indicated the site is generally covered with approximately 10 to 18 inches of topsoil and associated organic-rich root zone material at the locations observed. Underlying the topsoil layer, fine-textured silt and clay soils underlain by weathered conglomerate bedrock and competent conglomerate bedrock were encountered. Subsurface lithology may generally be described by the following soil types for engineering purposes.

Soil Type 1 – *Sandy SILT to Sandy FAT CLAY*

Soil Type 1 was observed to consist primarily of medium brown medium stiff, moist to wet, moderate to high plasticity sandy SILT to sandy FAT CLAY. Soil Type 1 was observed underlying the topsoil layer in test pits TP-3 through TP-6 and TP-8 to a maximum depth of 5 feet.

Analytical laboratory testing conducted upon representative soil samples obtained from test pits TP-3 (sandy SILT) and TP-6 (sandy FAT CLAY) indicate approximately 57 to 63 percent by weight passing the No. 200 sieve and in situ moisture content ranging from 32

to 36 percent. Atterberg test results indicated a liquid limit ranging from 44 to 51 percent and a plasticity index ranging from 16 to 25 percent. Soil Type 1 is classified as ML, sandy SILT, and CH, sandy FAT CLAY according to USCS specifications and A-7-6(7) and A-7-6(7) according to AASHTO specifications.

Soil Type 2 – Clayey SAND to Poorly Graded GRAVEL with silt and sand

Soil Type 2 was observed to consist primarily of light brown to multi-colored, dense to very dense, moist to wet, clayey SAND and poorly graded GRAVEL with silt and sand. Soil Type 2 represents weathered conglomerate bedrock. Soil Type 2 was encountered underlying surficial fine textured soils or topsoil in all test pits.

Analytical laboratory testing conducted upon representative soil samples obtained from test pit TP-8 indicate approximately 8 to 20 percent by weight passing the No. 200 sieve and in situ moisture content ranging from 33 to 43 percent. Atterberg test results indicated a liquid limit ranging from 43 to 46 percent and a plasticity index of 18 percent. Soil Type 2 is classified as SC, clayey SAND and GP-GM, poorly-graded GRAVEL with silt and sand according to USCS specifications and A-2-7(0) according to AASHTO specifications.

Soil Type 3: Weathered and Competent Conglomerate Bedrock

Weathered and competent conglomerate bedrock was encountered in all test pits at various depths. The conglomerate bedrock encountered generally resembled the descriptions of the unnamed Pleistocene to Pliocene, semi-consolidated, pebble to cobble conglomerate (QTc) and the Hyaoclastic sandstone member of the Troutdale formation (Ttfh). The bedrock consisted of angular to sub-rounded clasts of various sizes cemented in a matrix of sand, silt, and clay. The bedrock was very dense and excavator refusal was noted at various depths as indicated in Table 1 in Section 5.7, *Excavation.*

4.2.2 Groundwater

Groundwater was encountered in test pits TP-1 and TP-8 at depths of 2.5 feet and 15 feet below ground surface, respectively. Standing water was observed at the ground surface elevation in the wetland which occupies the central north portion of the site. According to *Clark County Maps Online*, the static aquifer elevation in the vicinity of the subject site ranges from 190 to 210 feet amsl. These elevations correspond to an approximate depth to groundwater between 0 and 20 feet below ground surface.

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. Piezometer installation and long-term monitoring, beyond the scope of this investigation, would be necessary to provide more detailed groundwater information.

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. 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 anticipated stripping depth for sod and highly organic topsoil is anticipated to vary from 10 to 18 inches. The required stripping depth may increase in areas of heavy organics, large tree root balls, 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, unsuitable, or undocumented 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.

Site grading activities should be performed in accordance with requirements specified in the 2012 *International Building Code* (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, grading activities, and demolition debris removal verification should be observed and documented by an experienced geotechnical engineer or designated representative.

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 upon prepared subgrade in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within three 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. Engineered fill placement should be observed by an experienced geotechnical engineer or designated representative.

Engineered structural fill placement activities should be performed during dry summer months if possible. If fill placement occurs during dry weather conditions, clean, fine-textured native soils are anticipated be suitable for use as structural fill if adequately

moisture-conditioned to achieve recommended compaction specifications. Areas of sandy FAT CLAY that may be encountered may not be suitable for building foundation subgrade or road subgrade embankments. The use of clay soils for structural fill should be analyzed by Columbia West during site grading activities.

Because they are moisture-sensitive, fine-textured soils such as Soil Type 1 are often difficult to excavate and compact during wet weather conditions. If adequate compaction is not achievable with clean, fine-textured soils, import fill consisting of well-graded granular material with a maximum particle size of three inches and no more than five percent passing the No. 200 sieve is recommended for structural fill.

Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by the geotechnical engineer prior to placement. Laboratory analyses should include particle-size gradation and 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 the geotechnical engineer 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 15 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 by an experienced geotechnical engineer.

5.4 Foundations

Review of preliminary site plans indicates that both residential and commercial/light industrial buildings are proposed. Foundations are anticipated to consist of shallow continuous perimeter or column spread footings. Footings should be designed by a licensed structural engineer and conform to the recommendations below. Typical building

loads are not expected to exceed approximately 3 to 4 kips per foot for perimeter footings or 80 kips per column. If actual loading exceeds anticipated loading, additional analysis should be conducted for the specific load conditions and proposed footing dimensions.

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 upon a 12-inch-thick layer of crushed aggregate base compacted to at least 95 percent of modified Proctor maximum dry density (ASTM D1557) placed on firm competent in situ soil or engineered structural fill. Disturbed surface soils and unsuitable fill should be removed from foundation alignments and replaced with structural fill.

Footings should have a minimum width of 18 inches and extend to a depth at least 18 inches below lowest adjacent grade to provide adequate bearing capacity and protection against frost heave. Foundations constructed during wet weather conditions may require over-excavation of saturated subgrade soils and granular structural backfill prior to concrete placement. Over-excavation recommendations should be provided by a qualified geotechnical engineer during foundation excavation and construction. Excavations adjacent to foundations should not extend within a 1.5H:1V angle projected down from the outside bottom footing edge without additional geotechnical analysis.

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, the estimated allowable bearing capacity for well-drained foundations prepared as described above and bearing on Soil Type 1 is 1,500 psf. The estimated allowable bearing capacity for well-drained foundations bearing upon Soil Types 2 and 3 is 2,000 psf. 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 0.35. Lateral forces may also be resisted by an assumed passive soil equivalent fluid pressure of 250 psf/f against embedded footings. The upper six inches of soil should be neglected in passive pressure calculations.

Foundations should not be permitted to bear upon existing fill, soft soil, or disturbed soil. Because soil is often heterogeneous and anisotropic, it is recommended that an experienced geotechnical engineer or designated representative observe foundation excavations prior to placing forms or reinforcing bar to verify subgrade support conditions are as anticipated in this report.

5.5 Slabs on Grade

The proposed structures may have slab-on-grade floors. Slabs should be supported on firm, competent, in situ 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 1

¼"-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. 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 Settlement

Total long-term static footing displacement for shallow to medium-depth 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 16.5 feet using a track-mounted excavator. As mentioned previously, weathered and competent conglomerate bedrock was encountered in all test pits at various depths ranging from 3 to 16.5 feet below ground surface. Table 1 presents a summary of depths to bedrock and groundwater.

Table 1. *Depth to bedrock and groundwater*.

Test Pit	Depth to Bedrock Refusal (feet below ground surface)	Depth of Seep or Groundwater (feet below ground surface)
TP-1	3	2.5
TP-2	3.5	not encountered
TP-3	4.5	not encountered
TP-4	3	not encountered
TP-5	4.5	not encountered
TP-6	6.5	not encountered
TP-7	3.5	not encountered
TP-8	16.5	15

The conglomerate was generally weathered in the top few feet, but became dense and massive with depth. If significant utilities or other excavations are designed at elevations that encounter bedrock, specialized rock-excavation techniques or blasting may be necessary. As mentioned previously, groundwater seeps were also observed during the site investigation, often at a depth coincident with the soil-to-bedrock interface.

Near-surface soils are likely classified as 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.

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 Dewatering

Groundwater elevation and hydrostatic pressure should be carefully considered during design of utilities, retaining walls, or other structures that require below-grade excavation. As described previously, groundwater may be encountered in the vicinity of proposed development areas. Utility trenches in shallow groundwater areas or excavations and cuts that remain open for even short periods of time may undermine or collapse due to groundwater effects. Placement of layers of riprap or quarry spalls in localized areas on shallow excavation side slopes may be required to limit instability. Over-excavation and stabilization of pipe trenches or other excavations with imported crushed aggregate or gabion rock may also be necessary to provide adequate subgrade support.

Pumping and dewatering may be required to temporarily reduce the groundwater elevation to allow construction of proposed below-grade structures, installation of utilities, or placement of structural fills. Dewatering via a sump within excavation zones may be insufficient to control groundwater and provide excavation side slope stability. Dewatering may be more feasibly conducted by installing a system of temporary well points and pumps around proposed excavation areas or utility trenches. Depending on proposed utility depths, a site-specific dewatering plan may be necessary. Well pumps should remain functioning at all times during the excavation and construction period. Suitable back-up pumps and power supplies should be available to prevent unanticipated shut-down of dewatering equipment. Failure to operate pumps full-time may result in flooding of the excavation zones, resulting in damage to forms, slopes, or equipment.

5.9 Lateral Earth Pressure

If retaining walls are proposed, lateral earth pressures should be carefully considered for design. Hydrostatic pressure and additional surcharge loading should also be considered. Retained material may include engineered structural backfill or undisturbed 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 in situ undisturbed native soils and engineered structural fill consisting of imported granular fill meeting WSDOT specifications for *Gravel Backfill for Walls 9-03.12(2)* are presented in Table 1. Soil Type 1 is excluded due to the relative thin profile observed on the site.

The design parameters presented in Table 2 are valid for static loading cases. The recommended earth pressures do not include surcharge loads, dynamic loading, hydrostatic pressure, or seismic design.

Table 2. Lateral Earth Pressure Parameters for Level Backfill

Backfill Material	Equivalent Fluid Pressure for Level Backfill			Wet Density	Drained Internal Angle of Friction
	At-rest	Active	Passive		
WSDOT 9-03.12(2) compacted aggregate backfill	54 pcf	33 pcf	589 pcf	135 pcf	38°
In situ undisturbed clayey SAND and Poorly Graded GRAVEL with silt and sand (Soil Type 2)	64 pcf	43 pcf	360 pcf	125 pcf	29°

** 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.*

If seismic design is required, 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 wall.

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 drainpipe design are presented in Section 5.12, *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 the geotechnical engineer or designated representative during construction.

5.10 Seismic Design Considerations

According to the *United States Geologic Survey (USGS) 2010 ASCE 7 Seismic Design Maps Summary Report,* the anticipated peak ground and maximum considered earthquake spectral response accelerations resulting from seismic activity for the subject site are summarized in Table 3.

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 and Fv as defined in 2012 IBC Tables 1613.3.3(1) and (2). 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 site soils may be represented by Site Class C. Based upon observed subsurface soil conditions at the site, and review of well logs and local

geologic maps, site soils may be considered to be Site Class C as defined in 2012 IBC Section 1613.3.5. This site class designation indicates that some amplification of seismic energy may occur during a seismic event because of subsurface conditions. This assessment is preliminary and is based upon limited field exploration and research of existing published literature. Additional exploration would be necessary to provide soil site class information at greater depths.

Table 3. 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	0.38 g
0.2 sec Spectral Acceleration	0.89 g
1.0 sec Spectral Acceleration	0.38 g

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 for the site is beyond the scope of this investigation. If site structures are designed in accordance with recommendations specified in the 2012 IBC, the potential for peak ground accelerations in excess of the adjusted and amplified values should be understood.

5.11 Soil Liquefaction and Dynamic Settlement

According to the *Alternative 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 or non-plastic silt 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.

Based upon the results of the geotechnical investigation, the potential for liquefaction of shallow soils at the site is considered to be low.

5.12 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. Concentrated discharge of water should be prohibited across slopes and water should not be diverted, routed, or allowed to flow over or across slope faces.

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 AOS between No. 70 and No. 100 sieve. The water permittivity should be greater than 1.5/sec. Figure 5 presents a typical foundation 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 the geotechnical engineer 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. The geotechnical engineer should be consulted to provide appropriate recommendations.

5.13 Bituminous Asphalt and Portland Cement Concrete

Preliminary site plans indicate that proposed development includes private asphalt concrete driveways and parking areas. Additionally, an extension of the City of Camas' NW Camas Meadows Drive may be constructed as part of the development. Pavement section thickness should be carefully considered to provide adequate lifespan and

serviceability. Pavement section design is outside the scope of this investigation; however, Columbia West can provide section design services in the future if requested. Columbia West recommends adherence to the City of Camas standards for public works construction if improvements to public roads are proposed.

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 later in Section 5.14, *Wet Weather Construction Methods and Techniques*. Areas proposed for asphalt pavement construction should be prepared as described in Section 5.1, *Site Preparation and Grading*. Subgrade conditions should be evaluated and tested by a licensed geotechnical engineer or designated representative prior to placement of crushed aggregate base. Subgrade evaluation should include nuclear gauge density testing and wheel proof-roll observations conducted with a 12-cubic yard, double-axle dump truck or equivalent. Nuclear gauge density testing should be conducted at 250-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 D698. Areas of observed deflection or rutting during proof-roll evaluation should be excavated to a firm surface and replaced with compacted crushed aggregate.

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 should be installed in accordance with the City of Camas specifications. Aggregate base should be observed and proof-rolled in the presence of an experienced geotechnical engineer or designated representative. 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 specimen at a frequency of four cylinders per 100 cubic yards of poured concrete. Recommended field and analytical laboratory 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, 4-inch by 6-inch gabion, or other similar material (6-inch maximum size with less than 5 percent passing the No. 200 sieve).

Construction equipment traffic across exposed fine-textured soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for soils above plastic limit. Wet weather construction may

generate significant excess quantities of soft wet soil, which should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Road base should consist of 3"-0 or 1¼"-0 crushed aggregate and should be placed on previously stripped and structurally competent subgrade. Over-excavation may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric such as Mirafi 500X or an approved equivalent is also recommended. Crushed aggregate base should be installed in a single lift with trucks end-dumping from an advancing layer of granular fill. During extended wet periods, stripping activities may also need to be conducted from an advancing layer 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 subgrade performance.

It should be understood that wet weather construction is risky and costly. An experienced geotechnical engineer or designated representative 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 tactifier, 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 species. 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 Soil Shrink/Swell Potential

Based upon laboratory analysis, subsurface soils contain as much as 63 percent by weight passing the No. 200 sieve and exhibit a plasticity index ranging from 16 to 25 percent. This indicates low to moderate potential for soil shrinking or swelling.

5.17 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 crushed aggregate or other coarse-textured, free-draining material acceptable to the client, City of Camas, and the site geotechnical engineer. 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 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. Even 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 significantly 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.

Daniel E. Lehto, PE, GE
Principal



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FIGURES



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	Design	Drawn: ASR		SITE LOCATION MAP
	Checked: DEL	Date: 6/12/15		
	Client: PACM, LLC	Rev / By / Date		PARKLANDS AT CAMAS MEADOWS CAMAS, WASHINGTON
	Job No.: 15153			
	CAD File: FIGURE 1			
	Scale: ~1:50,000			

FIGURE 1



NOTES:
1. SITE LOCATION: 2150 NE IONE STREET.
2. DRAWING IS NOT TO SCALE.
3. BASE MAP OBTAINED FROM BING MAPS.
4. TEST PIT LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
5. SOIL BOTING BACKFILLED WITH BENTONITE ON 6-26-2013.

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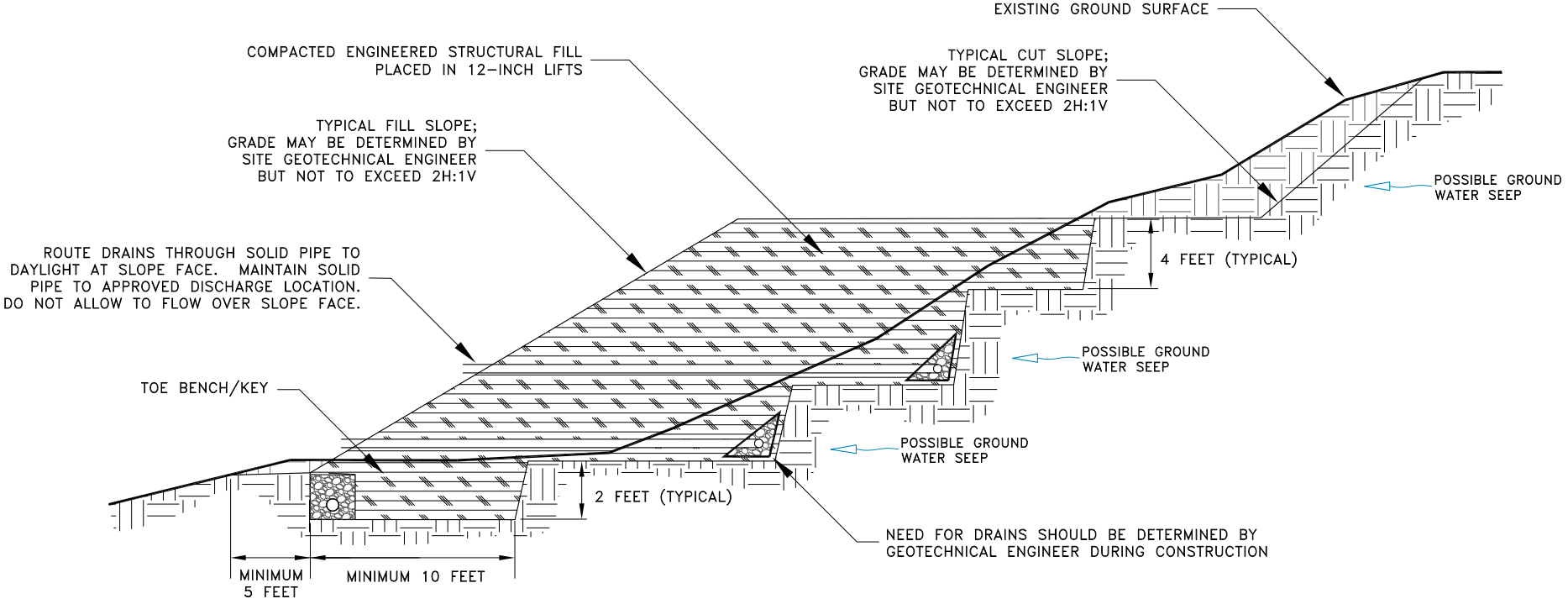
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Checked: DEL	Date: 6/12/15			
Client: PACM, LLC	Rev	By	Date	
Job No: 15153				
CAD File: FIGURE 2				
Scale: NONE				

SUBSURFACE EXPLORATION LOCATION MAP

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE
162

TYPICAL CUT AND FILL SLOPE CROSS-SECTION

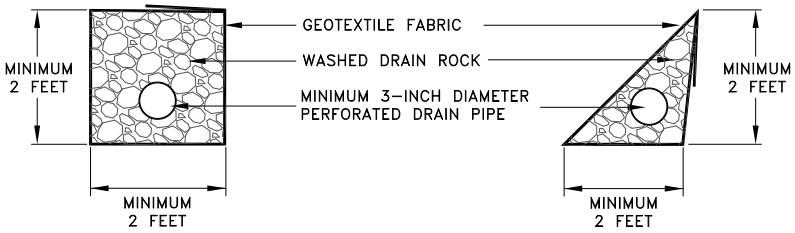


DRAIN SPECIFICATIONS

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.

TYPICAL DRAIN SECTION DETAIL



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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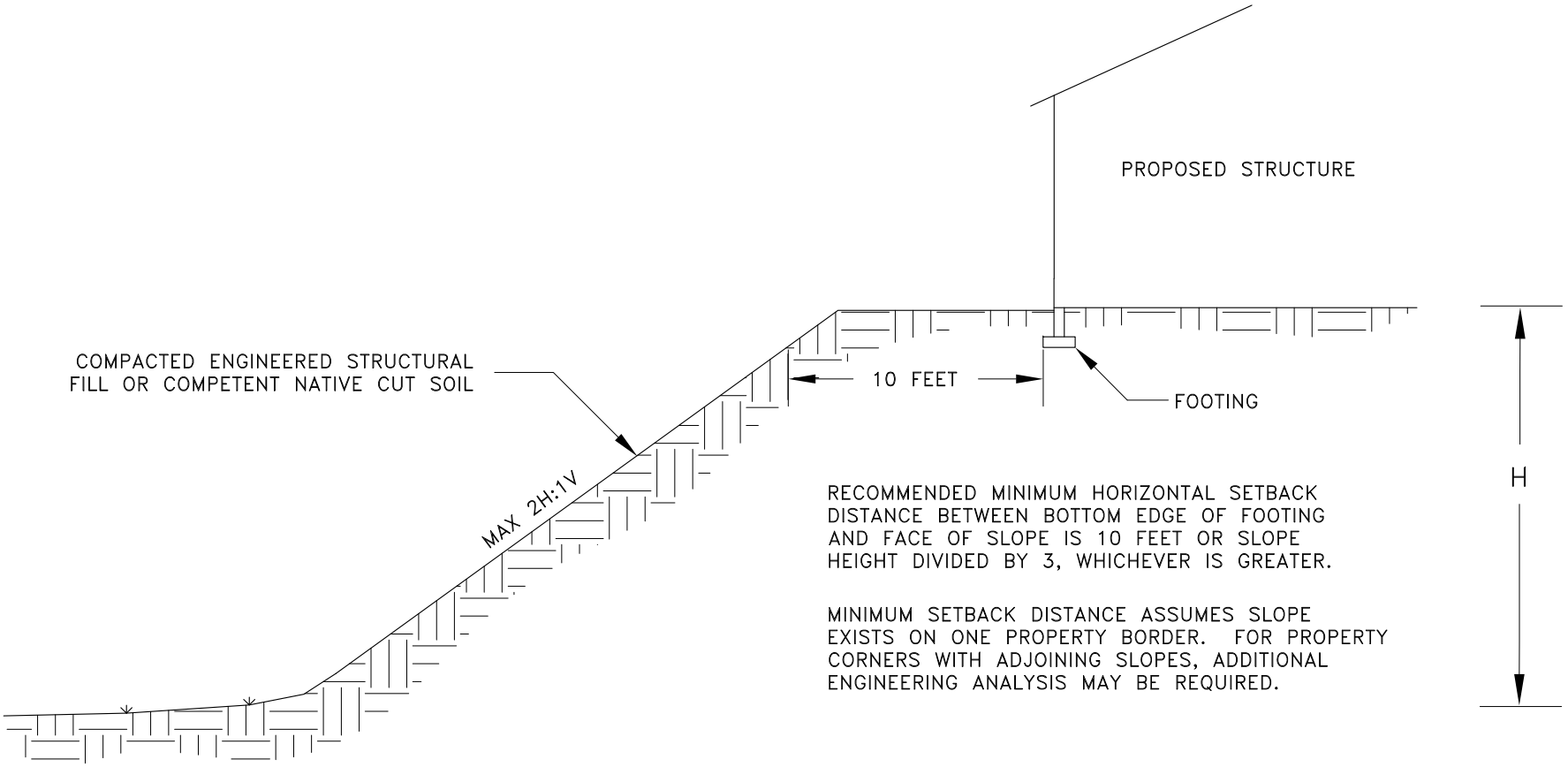
Design:	Drawn: ASR		
Checked: DEL	Date: 6/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 3			
Scale: NONE			

TYPICAL CUT AND FILL SLOPE CROSS–SECTION

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE 3

TYPICAL CUT AND FILL SLOPE CROSS-SECTION



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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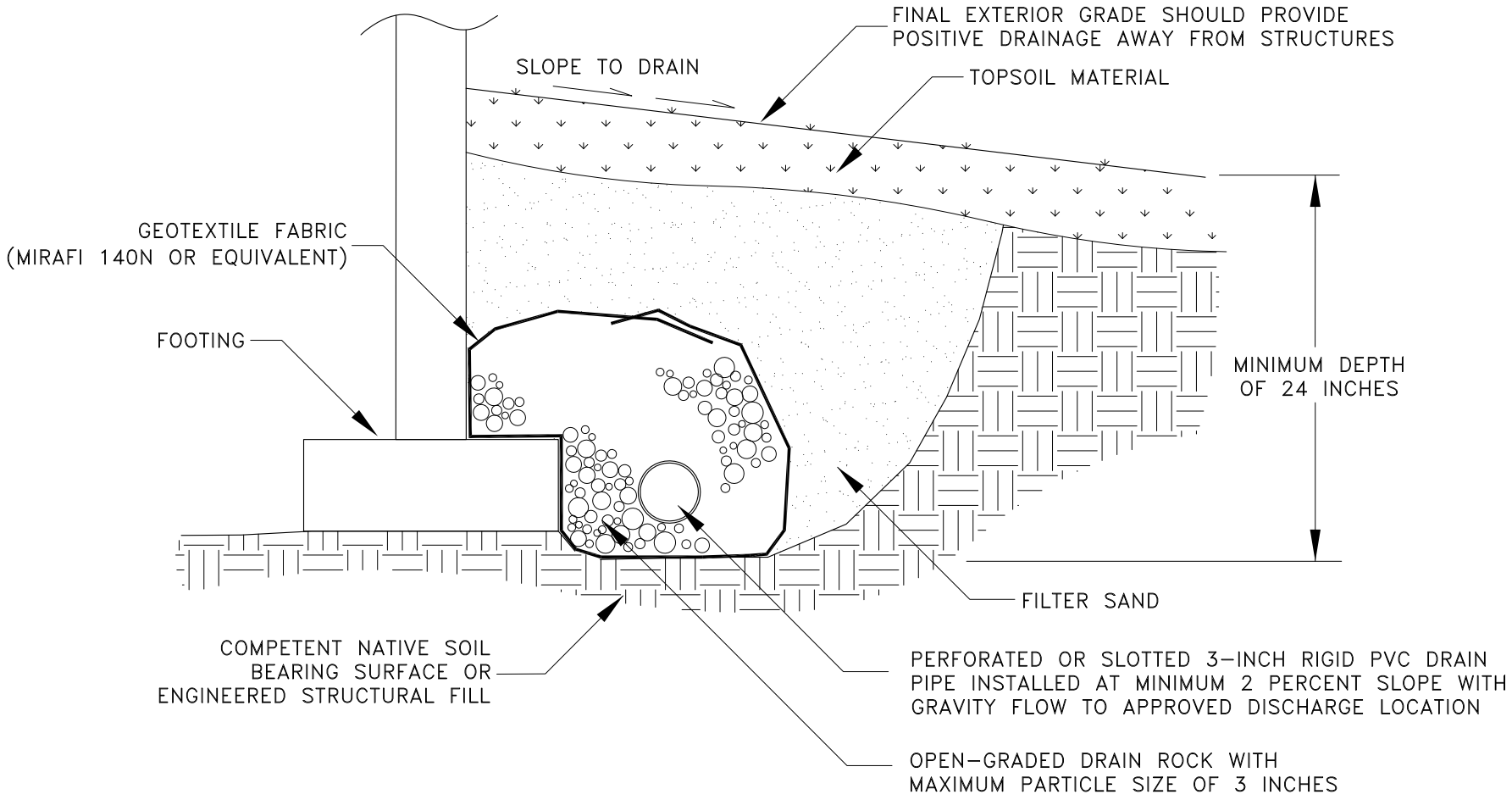
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Checked: DEL	Date: 06/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 4			
Scale: NONE			

MINIMUM FOUNDATION SLOPE SETBACK DETAIL

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE
164

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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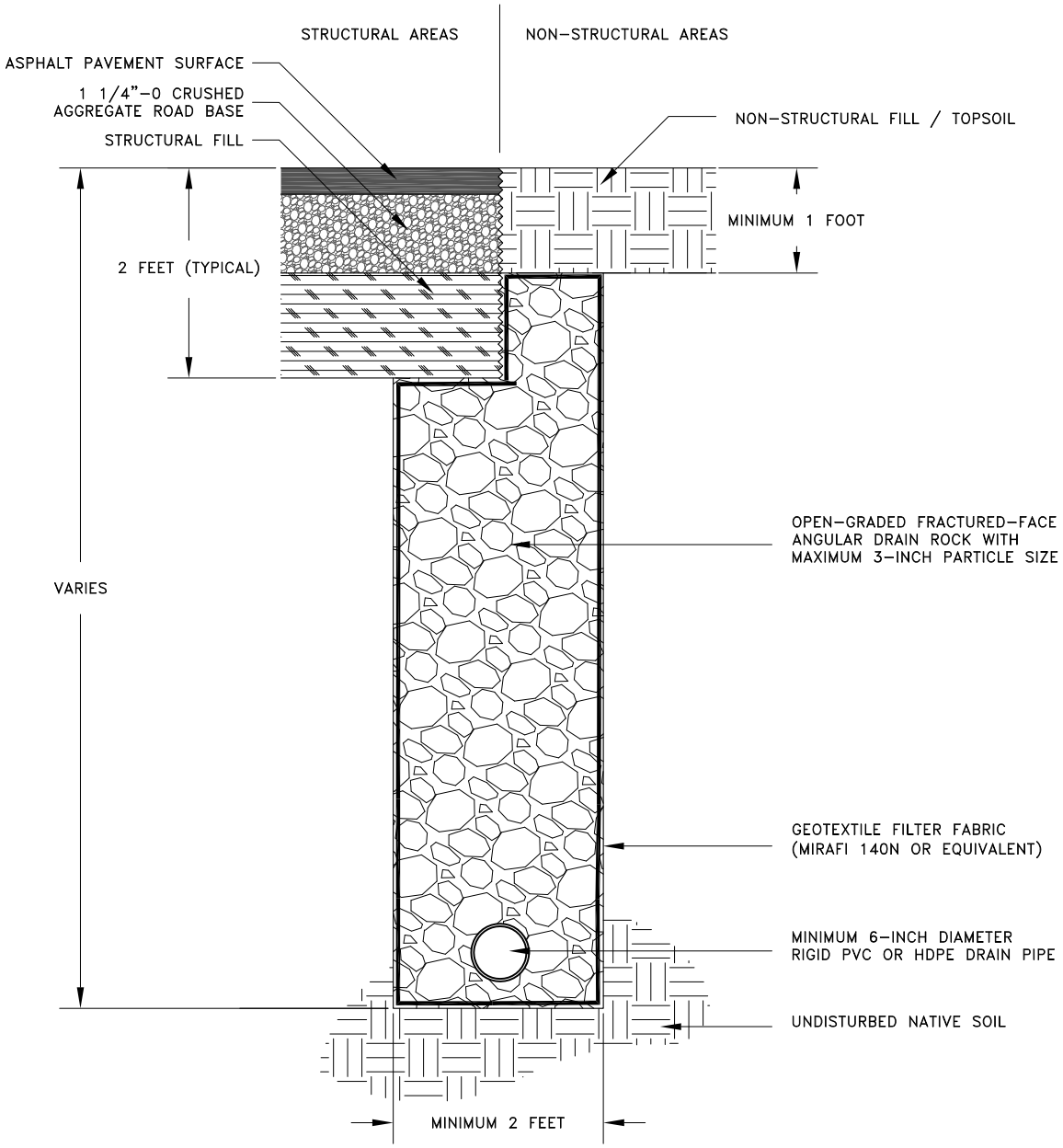
Design:	Drawn: ASR			
Checked: DEL	Date: 6/12/15			
Client: PACM, LLC	Rev	By	Date	
Job No: 15153				
CAD File: FIGURE 5				
Scale: NONE				

TYPICAL PERIMETER FOOTING DRAIN DETAIL

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE
165

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: ASR		
Checked: DEL	Date: 06/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 6			
Scale: NONE			

TYPICAL PERFORATED DRAIN PIPE TRENCH DETAIL

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE 6

APPENDIX A
ANALYTICAL LABORATORY TEST RESULTS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-359
		REPORT DATE 06/16/15	FIELD ID TP3.1
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy SILT	Test Pit TP-03 depth = 2 feet	ML, Sandy Silt
SPECIFICATIONS none		AASHTO SOIL TYPE A-7-6(7)

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Rainhart "Mary Ann" Sifter 637

TEST PROCEDURE: ASTM D6913, D422

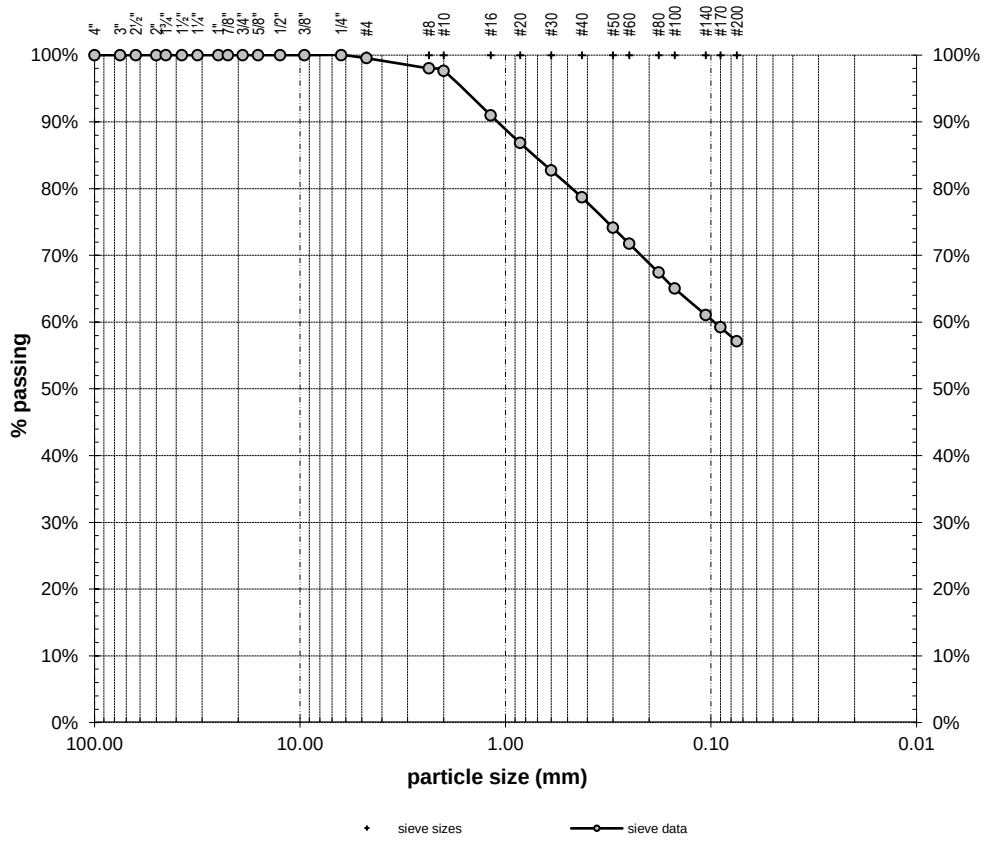
ADDITIONAL DATA

initial dry mass (g) =	158.3		
as-received moisture content =	36.4%	coefficient of curvature, C_C =	n/a
liquid limit =	44	coefficient of uniformity, C_U =	n/a
plastic limit =	28	effective size, $D_{(10)}$ =	n/a
plasticity index =	16	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	0.097 mm

SIEVE DATA

% gravel = 0.5%
% sand = 42.4%
% silt and clay = 57.1%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30	100.0%			
	#4	4.75	99.5%			
SAND	#8	2.36		98.0%		
	#10	2.00	97.6%			
	#16	1.18		91.0%		
	#20	0.850	86.8%			
	#30	0.600		82.7%		
	#40	0.425	78.7%			
	#50	0.300		74.1%		
	#60	0.250	71.7%			
	#80	0.180		67.4%		
	#100	0.150	65.0%			
	#140	0.106		61.1%		
	#170	0.090		59.2%		
	#200	0.075	57.1%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
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		REPORT DATE: 06/16/15	FIELD ID: TP3.1
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy SILT	Test Pit TP-03 depth = 2 feet	ML, Sandy Silt

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit = 44
plastic limit = 28
plasticity index = 16

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	33.30	33.31	33.93	
dry soil + pan weight, g =	29.59	29.37	29.72	
pan weight, g =	20.83	20.70	20.68	
N (blows) =	30	20	15	
moisture, % =	42.4 %	45.4 %	46.6 %	

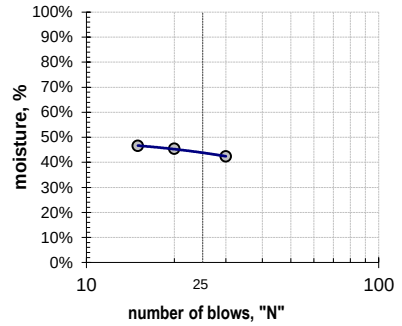
SHRINKAGE

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

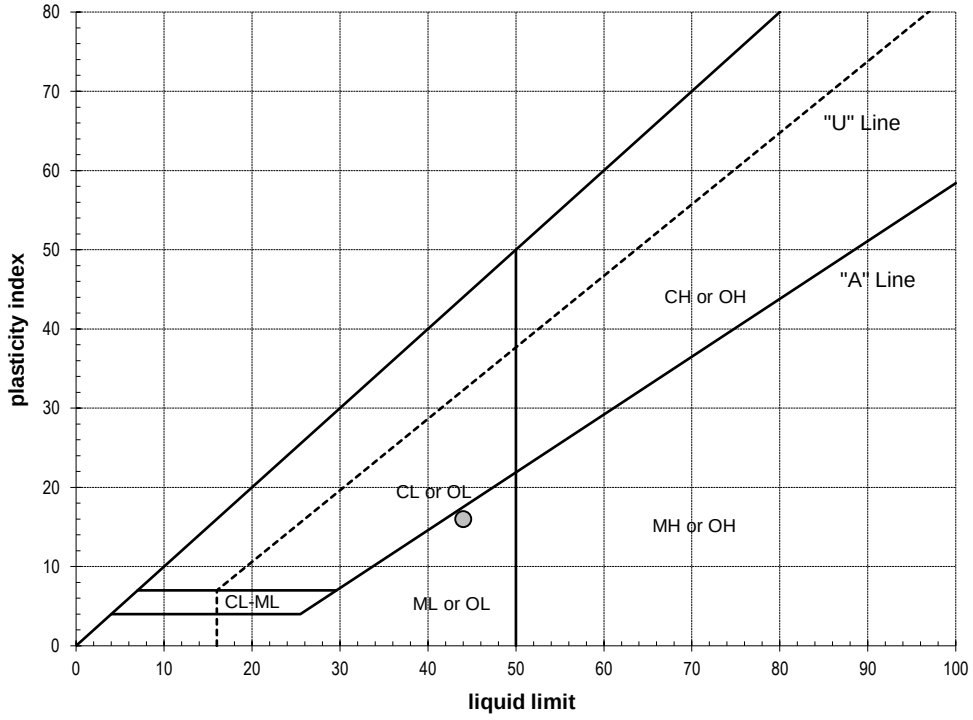
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.85	27.97		
dry soil + pan weight, g =	26.28	26.35		
pan weight, g =	20.69	20.50		
moisture, % =	28.1 %	27.7 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel = 0.5%
% sand = 42.4%
% silt and clay = 57.1%
% silt = n/a
% clay = n/a
moisture content = 36.4%

DATE TESTED	TESTED BY
06/15/15	MJR

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-360
		REPORT DATE 06/16/15	FIELD ID TP6.1
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Fat CLAY	Test Pit TP-06 depth = 2.5 feet	CH, Sandy Fat Clay
SPECIFICATIONS none		AASHTO SOIL TYPE A-7-6(14)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

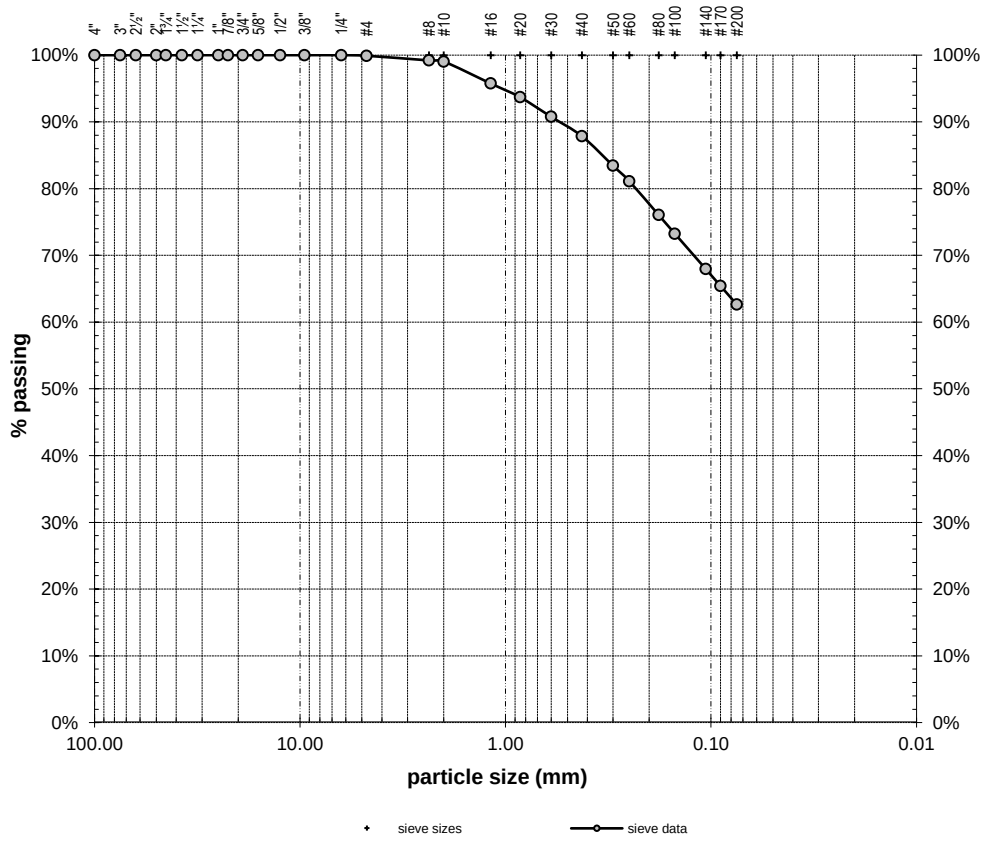
ADDITIONAL DATA

initial dry mass (g) =	173.4		
as-received moisture content =	32.3%	coefficient of curvature, C_C =	n/a
liquid limit =	51	coefficient of uniformity, C_U =	n/a
plastic limit =	26	effective size, $D_{(10)}$ =	n/a
plasticity index =	25	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel =	0.1%
% sand =	37.3%
% silt and clay =	62.6%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30	100.0%			
	#4	4.75	99.9%			
SAND	#8	2.36		99.2%		
	#10	2.00	99.0%			
	#16	1.18		95.7%		
	#20	0.850	93.7%			
	#30	0.600		90.8%		
	#40	0.425	87.9%			
	#50	0.300		83.4%		
	#60	0.250	81.1%			
	#80	0.180		76.1%		
	#100	0.150	73.2%			
	#140	0.106		67.9%		
	#170	0.090		65.4%		
	#200	0.075	62.6%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

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		REPORT DATE: 06/16/15	FIELD ID: TP6.1
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Fat CLAY	Test Pit TP-06 depth = 2.5 feet	CH, Sandy Fat Clay

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	51
plastic limit =	26
plasticity index =	25

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	34.63	34.09	37.32	
dry soil + pan weight, g =	30.07	29.61	31.60	
pan weight, g =	20.69	20.73	20.85	
N (blows) =	33	25	15	
moisture, % =	48.6 %	50.5 %	53.2 %	

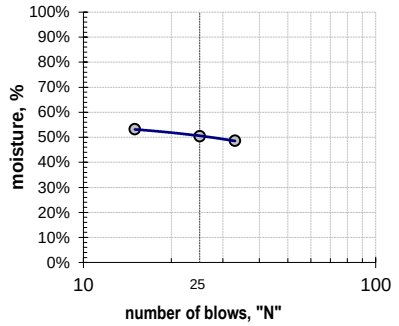
SHRINKAGE

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

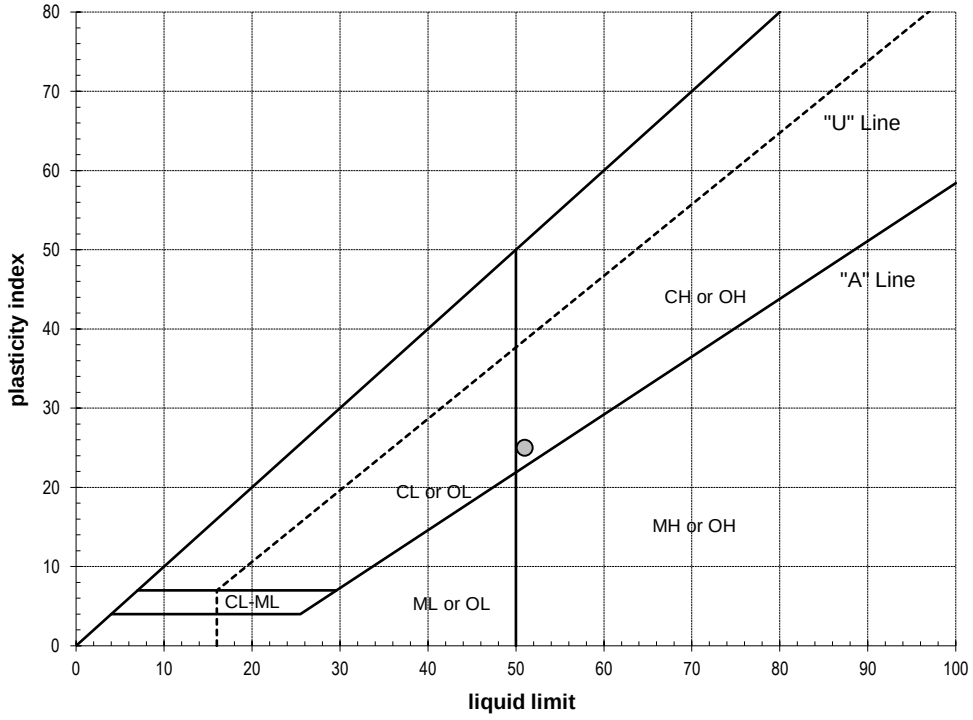
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.64	27.63		
dry soil + pan weight, g =	26.18	26.21		
pan weight, g =	20.69	20.82		
moisture, % =	26.6 %	26.4 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.1%
% sand =	37.3%
% silt and clay =	62.6%
% silt =	n/a
% clay =	n/a
moisture content =	32.3%

DATE TESTED	TESTED BY
06/15/15	MJR

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PARTICLE-SIZE ANALYSIS REPORT

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		REPORT DATE 06/16/15	FIELD ID TP8.2
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Clayey SAND	Test Pit TP-08 depth = 8 feet	SC, Clayey Sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-2-7(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

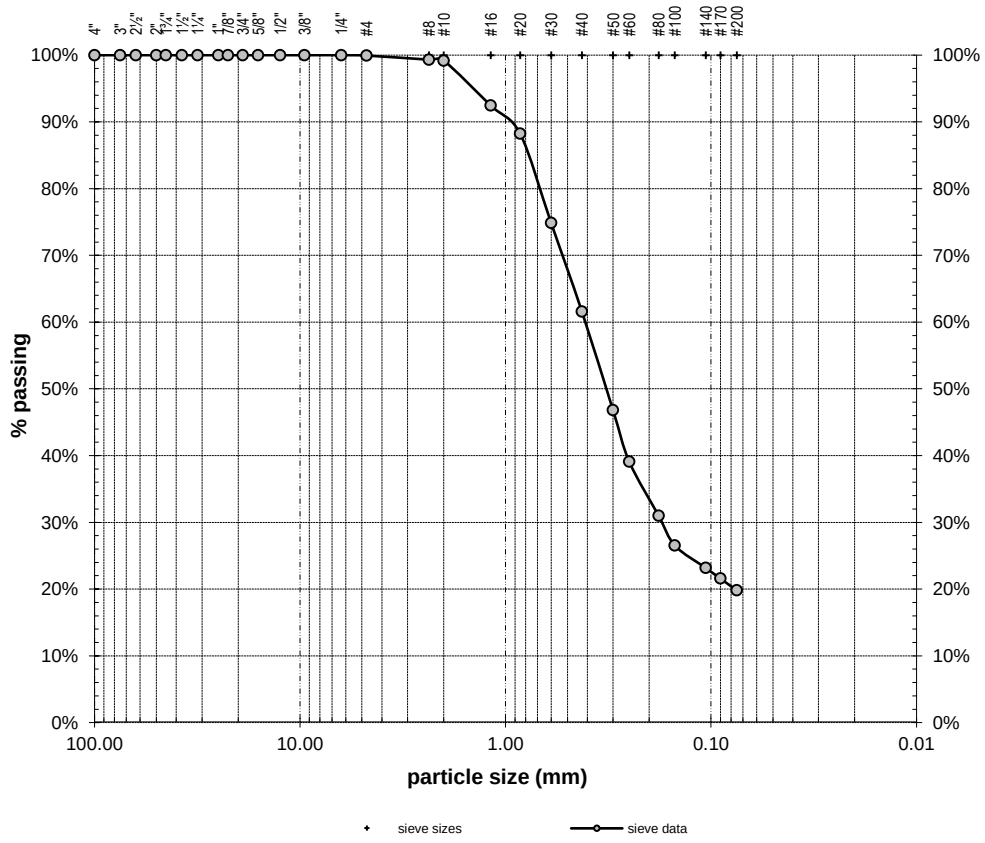
ADDITIONAL DATA

initial dry mass (g) =	151.9		
as-received moisture content =	42.6%	coefficient of curvature, C_C =	n/a
liquid limit =	43	coefficient of uniformity, C_U =	n/a
plastic limit =	25	effective size, $D_{(10)}$ =	n/a
plasticity index =	18	$D_{(30)}$ =	0.173 mm
fineness modulus =	n/a	$D_{(60)}$ =	0.410 mm

SIEVE DATA

% gravel =	0.1%
% sand =	80.1%
% silt and clay =	19.8%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30	100.0%			
	#4	4.75	99.9%			
SAND	#8	2.36		99.3%		
	#10	2.00	99.2%			
	#16	1.18		92.4%		
	#20	0.850	88.3%			
	#30	0.600		74.8%		
	#40	0.425	61.6%			
	#50	0.300		46.8%		
	#60	0.250	39.1%			
	#80	0.180		31.0%		
	#100	0.150	26.5%			
	#140	0.106		23.2%		
	#170	0.090		21.6%		
	#200	0.075	19.8%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-361
		REPORT DATE: 06/16/15	FIELD ID: TP8.2
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Clayey SAND	Test Pit TP-08 depth = 8 feet	SC, Clayey Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	43
plastic limit =	25
plasticity index =	18

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	39.55	37.83	35.98	
dry soil + pan weight, g =	33.98	32.70	31.23	
pan weight, g =	20.69	20.73	20.63	
N (blows) =	30	23	17	
moisture, % =	41.9 %	42.9 %	44.8 %	

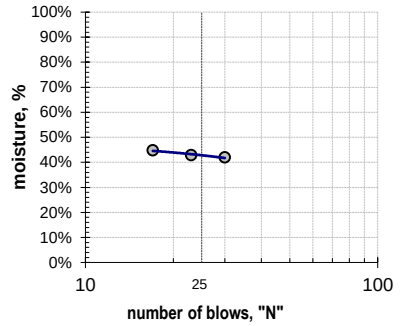
SHRINKAGE

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

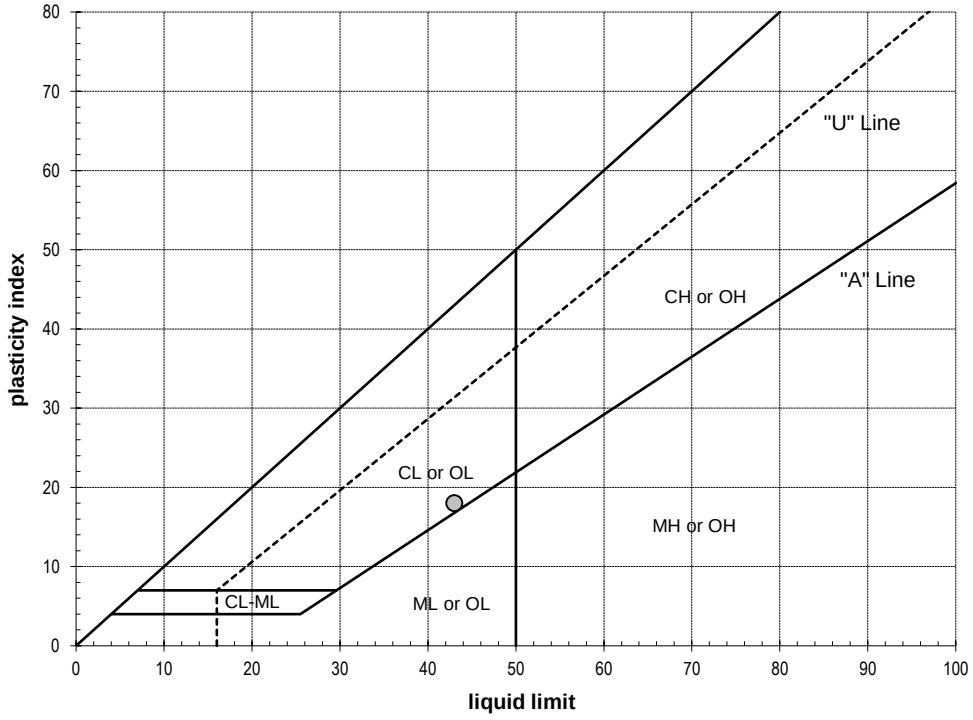
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.97	28.28		
dry soil + pan weight, g =	26.54	26.79		
pan weight, g =	20.74	20.77		
moisture, % =	24.7 %	24.8 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.1%
% sand =	80.1%
% silt and clay =	19.8%
% silt =	n/a
% clay =	n/a
moisture content =	42.6%

DATE TESTED	TESTED BY
06/15/15	MJR

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-362
		REPORT DATE 06/16/15	FIELD ID TP8.3
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded GRAVEL with Silt and Sand	Test Pit TP-08 depth = 12 feet	GP-GM, Poorly graded gravel with silt and sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-2-7(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

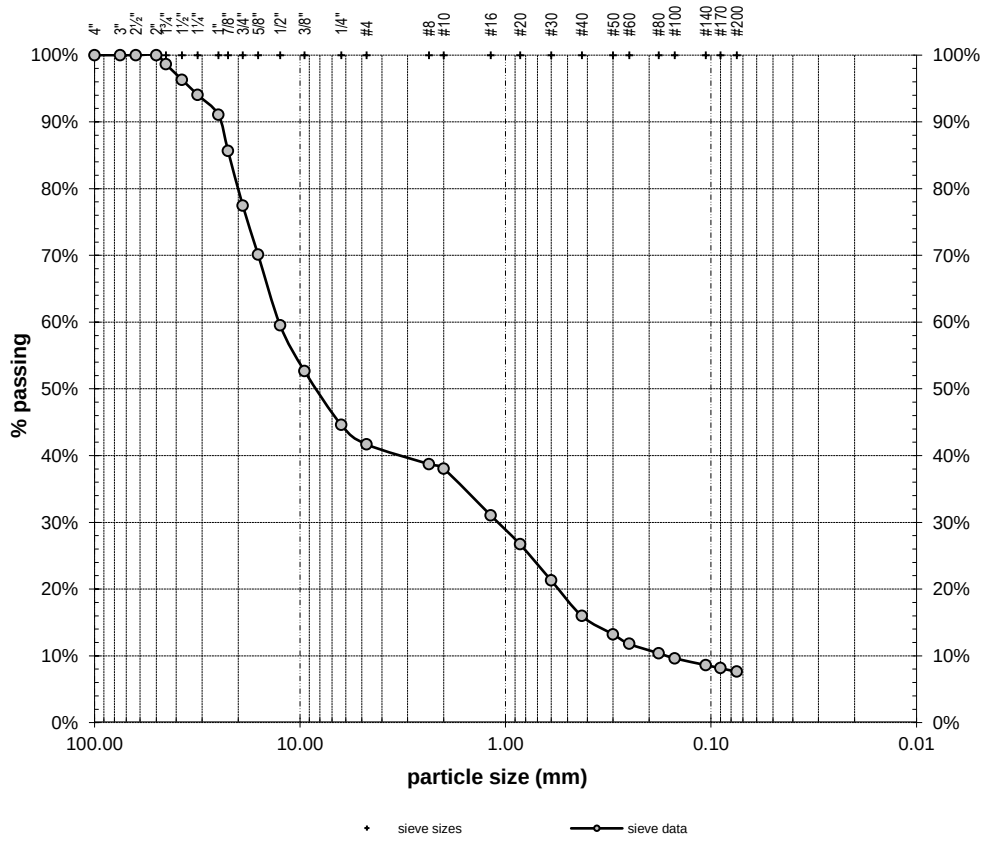
ADDITIONAL DATA

initial dry mass (g) =	3089.1		
as-received moisture content =	33.2%	coefficient of curvature, C_C =	0.57
liquid limit =	46	coefficient of uniformity, C_U =	76.93
plastic limit =	28	effective size, $D_{(10)}$ =	0.164 mm
plasticity index =	18	$D_{(30)}$ =	1.091 mm
fineness modulus =	n/a	$D_{(60)}$ =	12.637 mm

SIEVE DATA

% gravel = 58.3%
% sand = 34.1%
% silt and clay = 7.6%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0	100.0%			
	1.75"	45.0		98.6%		
	1.50"	37.5		96.3%		
	1.25"	31.5		94.0%		
	1.00"	25.0	91.1%			
	7/8"	22.4		85.6%		
	3/4"	19.0	77.5%			
	5/8"	16.0		70.1%		
	1/2"	12.5	59.5%			
	3/8"	9.50	52.6%			
	1/4"	6.30	44.6%			
	#4	4.75	41.7%			
SAND	#8	2.36		38.7%		
	#10	2.00	38.0%			
	#16	1.18		31.0%		
	#20	0.850	26.7%			
	#30	0.600		21.3%		
	#40	0.425	16.0%			
	#50	0.300		13.2%		
	#60	0.250	11.8%			
	#80	0.180		10.4%		
	#100	0.150	9.6%			
	#140	0.106		8.6%		
	#170	0.090		8.1%		
	#200	0.075	7.6%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-362
		REPORT DATE: 06/16/15	FIELD ID: TP8.3
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded GRAVEL with Silt and Sand	Test Pit TP-08 depth = 12 feet	GP-GM, Poorly graded gravel with silt and sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit = 46
plastic limit = 28
plasticity index = 18

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	39.57	37.55	37.51	
dry soil + pan weight, g =	33.76	32.29	32.08	
pan weight, g =	20.69	20.82	20.87	
N (blows) =	35	25	18	
moisture, % =	44.5 %	45.9 %	48.4 %	

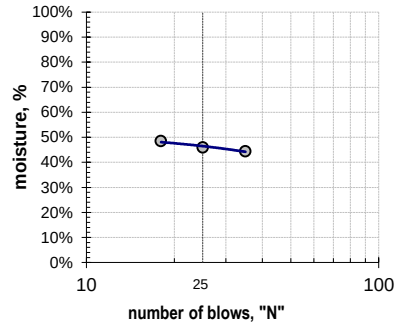
SHRINKAGE

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

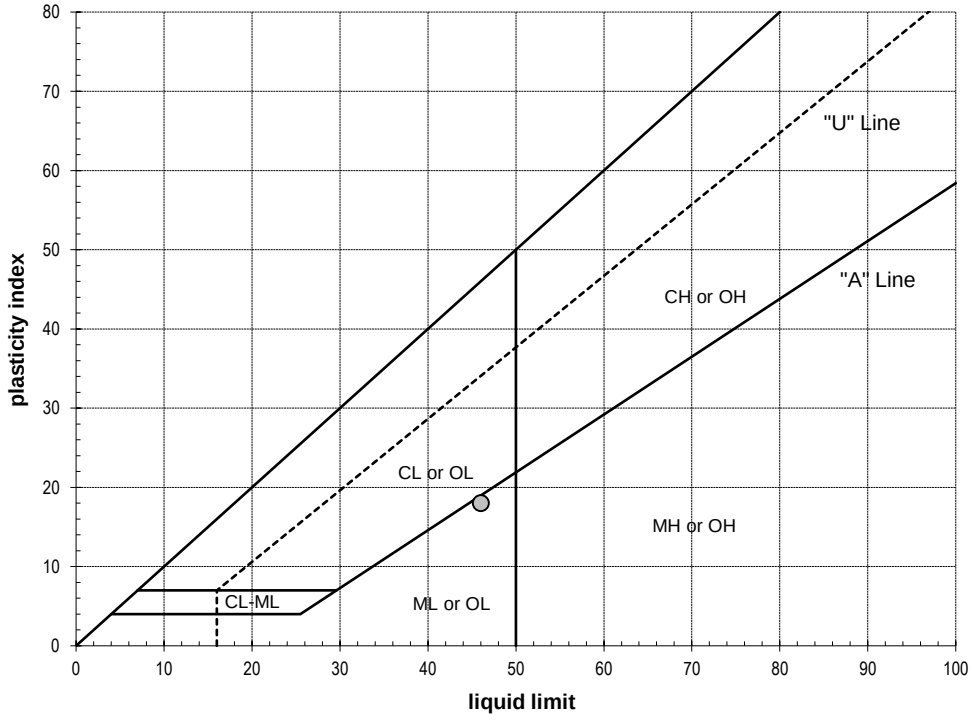
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.57	27.51		
dry soil + pan weight, g =	26.11	26.06		
pan weight, g =	20.82	20.80		
moisture, % =	27.6 %	27.6 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	58.3%
% sand =	34.1%
% silt and clay =	7.6%
% silt =	n/a
% clay =	n/a
moisture content =	33.2%

DATE TESTED	TESTED BY
06/15/15	MJR

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APPENDIX B
SUBSURFACE EXPLORATION LOGS

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-1
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	186	2.5 ft bgs	1030	1035

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 topsoil and root zone material.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated. Represents weathered conglomerate bedrock.					
						Difficult excavation. 6" to 8" weathered cobbles observed.					
						Refusal at 3.0 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.0 feet. Groundwater encountered at 2.5 feet.					
5											
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-2
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	190	Not encountered.	1000	1015

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 12 to 14 inches of topsoil and root zone material.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated. Represents weathered conglomerate bedrock. Difficult excavation. 6" to 8" weathered cobbles observed.					
5						Refusal at 3.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-3
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	208	Not encountered.	1115	1130

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 16 to 18 inches of topsoil and root zone material.					
	TP3.1		A-7-6(7)	CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.	36.4	57.1	44	16	
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation.					
5						Refusal at 4.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 4.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-4
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	214	Not encountered.	1150	1200

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 12 to 16 inches of topsoil and root zone material.					
				CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock.					
5						Refusal at 3.0 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.0 feet. Groundwater not encountered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-5
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	228	Not encountered.	1245	1255

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 12 to 14 inches of topsoil and root zone material.					
				CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation.					
5						Refusal at 4.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 4.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-6
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	210	Not encountered.	1215	1230

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 12 to 14 inches of topsoil and root zone material.					
	TP6.1		A-7-6(14)	CH		Brown sandy FAT CLAY, moist, medium stiff, fines are moderate to high plasticity.	32.3	62.6	51	25	
5				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation. 6" to 8" weathered cobbles observed.					
10						Refusal at 6.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 6.5 feet. Groundwater not encountered.					
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-7
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	218	Not encountered.	810	815

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 12 to 14 inches of topsoil and root zone material.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation. 6" to 8" weathered cobbles observed.					
5						Refusal at 3.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-8
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	210	Not encountered	830	900

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 16 to 18 inches of topsoil and root zone material.					
				CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.					
5											
	TP8.2		A-2-7(0)	SC		Light brown clayey SAND, moist, dense, lightly cemented, fines are medium plasticity. Difficult excavation.	42.6	19.8	43	18	
10											
	TP8.3		A-2-7(0)	GP-GM		Poorly graded GRAVEL with silt and sand, dense, saturated, gravels are subrounded to rounded. Groundwater seep.	33.2	7.6	46	18	
15						Refusal at 16.5 feet, competent conglomerate bedrock encountered.. Bottom of test pit at 16.5 feet. Groundwater encoutered at 15.5 feet.					
20											

APPENDIX C
SOIL CLASSIFICATION INFORMATION

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.

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 Percent or Less Passing .075 mm)				Silt-Clay Materials (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		

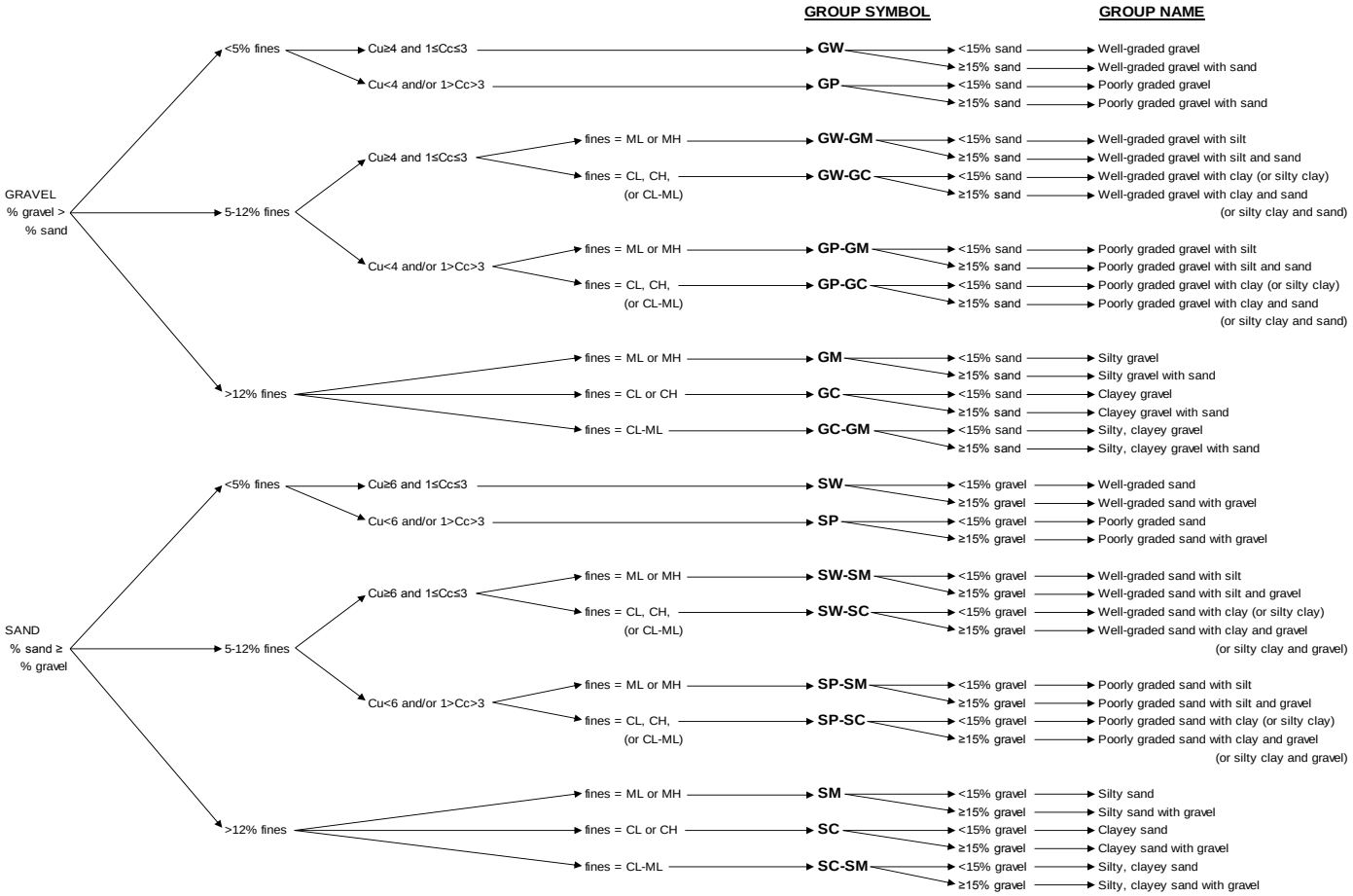
Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

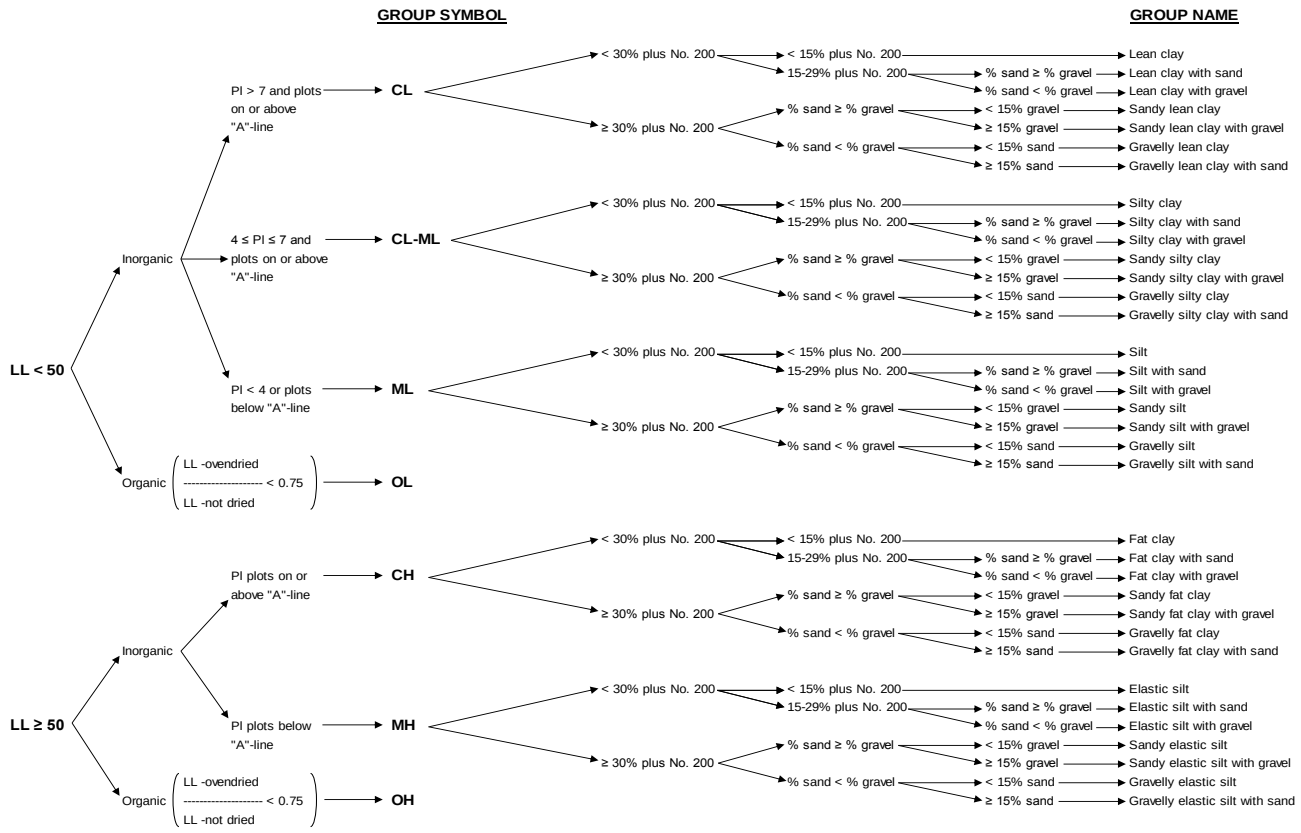
General Classification	Granular Materials (35 Percent or Less Passing 0.075 mm)							Silt-Clay Materials (More than 35 Percent Passing 0.075 mm)			
	A-1			A-2							A-7
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5, A-7-6
Sieve analysis, percent passing:											
2.00 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



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)

APPENDIX D
PHOTO LOG

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PHOTO LOG
Parklands at Camas Meadows
Camas, Washington



Shallow conglomerate bedrock in Test Pit TP-1



Shallow hyaoclastic sandstone bedrock in Test Pit TP-3



Shallow groundwater near Test Pit TP-1



Deeper conglomerate bedrock encountered in Test Pit TP-8

APPENDIX E
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

Date: June 23, 2015
Project: Parklands at Camas Meadows
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

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.

Operations and Maintenance Manual
Appendix E

Catch Basin Maintenance Guide	**E1**
Manhole Maintenance Guide	**E2**
Stormwater Conveyance Pipe Maintenance Guide	**E3**
Contech Stormfilter Maintenance Guide	**E4**

Catch Basin

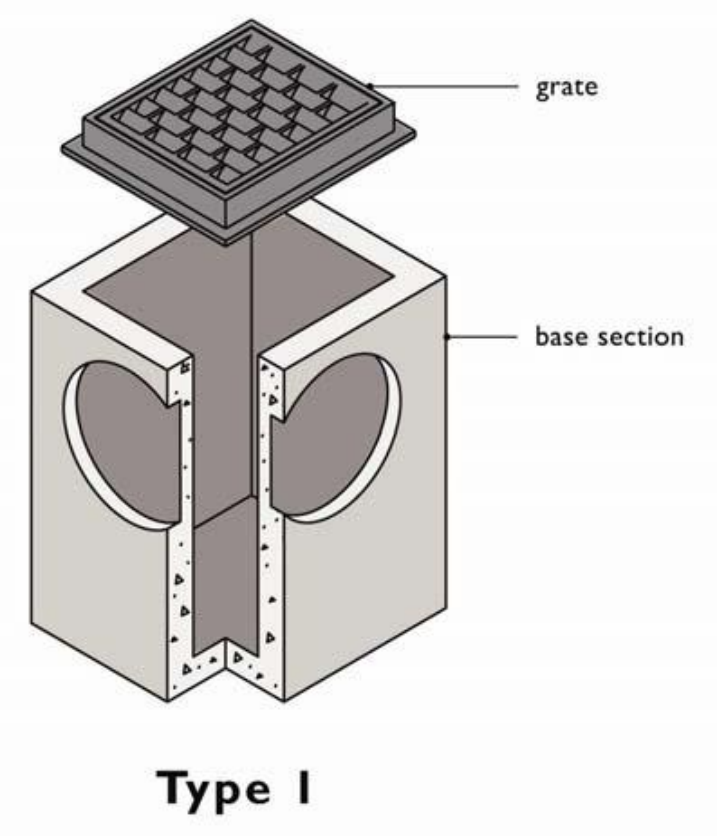
A catch basin is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two types.

A Type 1 catch basin is a rectangular box with approximate dimensions of 3'x2'x5'. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

A Type 2 catch basin, also commonly referred to as a storm manhole, is listed separately under "Manhole" in this book.

Catch basins typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or debris.

Catch basins are frequently associated with all stormwater facilities.



Key Operations and Maintenance Considerations

- The most common tool for cleaning catch basins is an industrial vacuum truck with a tank and vacuum hose (e.g. Vactor® truck) to remove sediment and debris from the sump.
- A catch basin may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Catch Basin			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin.)	Top slab is 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.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.

	Basin 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.	Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation Inhibiting System	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source, AND • Report to Clark County Clean Water Program.	No contaminants or pollutants present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed.
	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.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure (Intent is to keep cover from sealing off access to maintenance).	Cover can be removed by one maintenance person.
Metal Grates (If Applicable)	Grate Opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Oil/Debris Trap (If Applicable)	Dislodged	Oil or debris trap is misaligned with or dislodged from the outlet pipe.	Trap is connected to and aligned with outlet pipe.

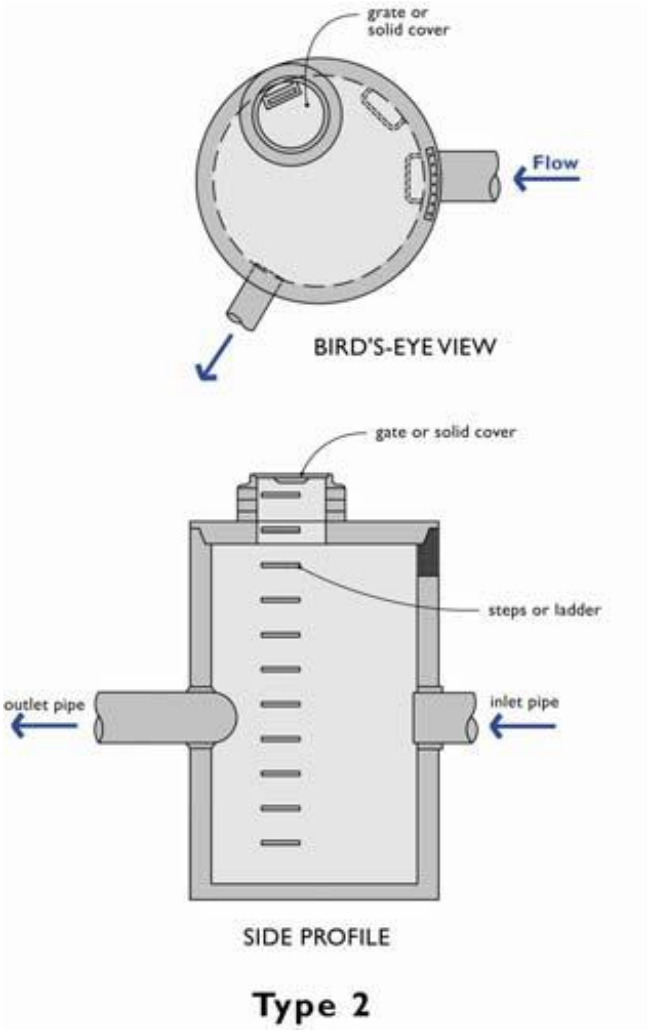
Manhole

A manhole is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Manholes can also be used as a junction in a pipe system and may have a solid lid. A manhole is also known as a Type 2 catch basin.

Manholes are round concrete structures ranging in diameter from 4 feet to 8 feet. They are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Manholes typically have steps mounted on the side of the structure to allow access.

Manholes typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some manholes are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils.

Manholes are often associated with other stormwater facilities.



Key Operations and Maintenance Considerations

- The most common tool for cleaning manholes is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the sump.
- A manhole may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a manhole, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Manhole			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Trash and Debris	Trash or debris which is located immediately in front of the opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of manhole or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the basin.
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into manhole.)	Top slab is 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.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		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.	Pipe is regrouted and secure at basin wall.

	Settlement/ Misalignment	If failure of manhole has created a safety, function, or design problem.	Manhole replaced or repaired to design standards.
	Vegetation Inhibiting System	Vegetation growing across and blocking more than 10% of the opening.	No vegetation blocking opening to manhole.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source, AND • Report to Clark County Clean Water Program.	No contaminants or pollutants present.
Manhole Cover	Cover Not in Place	Cover is missing or only partially in place. Any open manhole is a safety hazard and requires immediate maintenance.	Manhole cover is closed.
	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.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure (Intent is to keep cover from sealing off access to maintenance).	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to manhole wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate Opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Stormwater Conveyance Pipe

Storm sewer pipes convey stormwater. Inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities.

Pipes are built from many materials and are sometimes perforated to allow stormwater to infiltrate into the ground. Pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

Key Operations and Maintenance Considerations

- The most common tool for cleaning stormwater conveyance pipes is a truck with a tank, vacuum hose, and a jet hose (Vactor® truck) to flush sediment and debris from the pipes.

Stormwater Conveyance Pipe			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source, AND • Report to Clark County Clean Water Program.	No contaminants or pollutants present.
	Drainage Slow	Decreased capacity that indicates slow drainage. Does not meet facility design infiltration rate. The Water Quality Design Storm Volume does not infiltrate within 48 hours (if perforated pipe). Water remains in the pipe for greater than 24 hours after the end of most moderate rainfall events.	Perforated drain pipe has been cleaned and drainage rates are per design specifications. (Do not allow removed sediment and water to discharge back into the storm sewer.)
	Obstructions, Including Roots	Root enters or deforms pipe, reducing flow.	Roots have been removed from pipe (using mechanical methods; do not put root-dissolving chemicals in storm sewer pipes). If necessary, vegetation over the line removed.
	Pipe Dented or Broken	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced per design standards.
	Pipe Rusted or Deteriorated	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired and/or replaced per design standards.
	Sediment and Debris	Sediment depth is greater than 20% of pipe diameter.	Pipe has been cleaned and is free of sediment/ debris. (Upstream debris traps installed where applicable.)
	Debris Barrier or Trash Rack Missing	Stormwater pipes > than 18 inches need debris barrier.	Debris barrier present on all stormwater pipes 18 inches and greater.

CONTECH®
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures



Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.



In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..



Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit and the unit's role, relative to detention or retention facilities onsite.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered).

Please note Stormwater Management StormFilter devices installed downstream of, or integrated within, a stormwater storage facility typically have different operational parameters (i.e. draindown time). In these cases, the inspector must understand the relationship between the retention/detention facility and the treatment system by evaluating site specific civil engineering plans, or contacting the engineer of record, and make adjustments to the below guidance as necessary. Sediment deposition depths and patterns within the StormFilter are likely to be quite different compared to systems without upstream storage and therefore shouldn't be used exclusively to evaluate a need for maintenance.

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. While not required in all cases, inspection of the media within the cartridge may provide valuable additional information.
   b. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.



Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.







Inspection Report

Date: _____ Personnel: _____

Location: _____ System Size: _____ Months in Service: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

Sediment Thickness in Forebay: _____ Date: _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: _____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: _____

☐ Minor Structural Repairs: _____

☐ Drainage Area Report _____

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

Items Needing Further Work: _____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

_____

_____

_____

_____

_____

_____

_____

_____

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Months in Service: _____

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

_____

_____

_____

_____

_____

_____

_____

RECYCLED PAPER

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Support

- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

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PARKLANDS II

2026-04-03

Preliminary Stormwater Statement

The purpose of this narrative is to give an overview of the existing stormwater conditions on the site and proposed storm design options to obtain contingent vesting. The proposed improvements indicated in this narrative are shown on the preliminary plat.

The site contains 2 parcels located at 3711 and 3815 NW Camas Meadows Drive in Camas, Washington. The two parcels associated with this project are 986043913 and 986043914 and equals approximately 3.25 acres. This project was previously designed and approved under the Parklands at Camas Meadows Master Plan and the current conditions of this project site include an existing storm designed for the previously approved Business Park concept. This project will go through a plat alteration concurrently with the preliminary design, which will require some storm lines to be redesigned. This project will consist of constructing a new private roadway, sidewalks, lot grading, stormwater treatment, collection, infiltration and/or conveyance and other utilities necessary to develop the property.

Various forms of runoff treatment and flow control can be utilized with this project and will comply with the stormwater requirements under the CMC Title 14 and the stormwater manual. Some LID techniques, such as bioretention facilities or pervious pavement, coupled with some conventional treatment and disposal methods may be used to produce more efficient and aesthetic stormwater treatment.

Overflow systems may be utilized for added safety where feasible. Roof runoff from buildings may utilize individual roof downspout systems with drywells or infiltration trenching.

All necessary research, analysis and calculations for the proposed stormwater plan will be included in the preliminary application in the Technical Information Report.

Sincerely,

Joe Intermill IV, PE
Nate Horvath, Planner

PARKLANDS II SHORT PLAT

CAMAS, WASHINGTON (SW1/4,S28,T2N,R3E)

DEVELOPER

MAS1A LLC
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3405 NW MCMASTER DRIVE
CAMAS, WASHINGTON 98607
PHONE (360) 798-2400
JONELLSWORTHRE@GMAIL.COM

GEOTECHNICAL ENGINEER

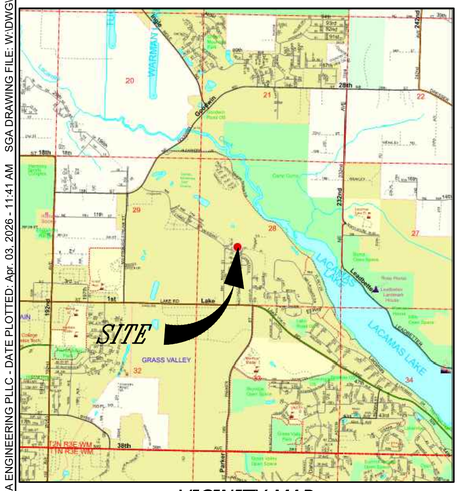
COLUMBIA WEST ENGINEERING, INC
11917 NE 95TH STREET
VANCOUVER, WASHINGTON 98682
PHONE (360) 823-2900

CONTACT

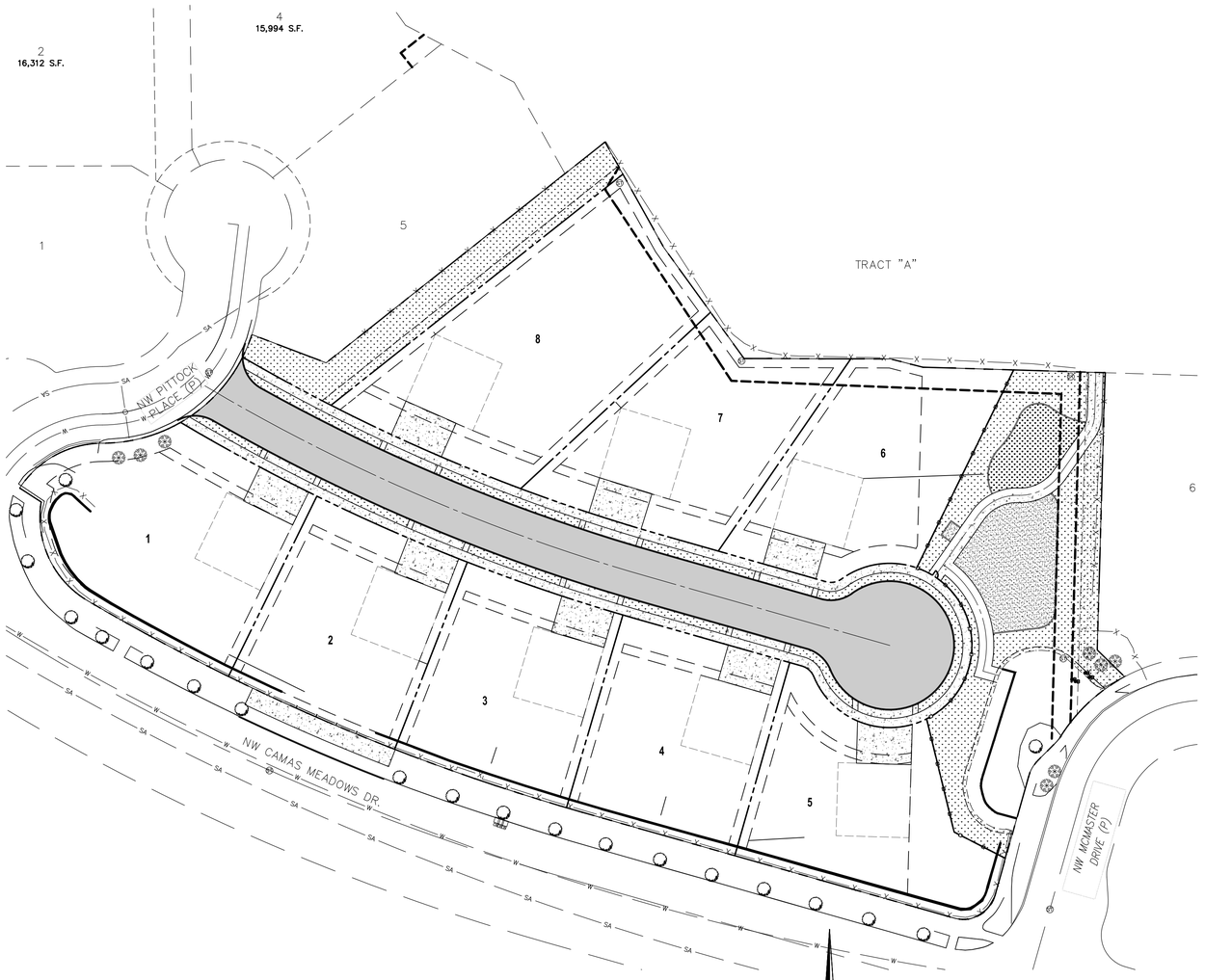
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SURVEYOR

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VANCOUVER, WASHINGTON 98661
PHONE (360) 694-3313
DAR@MGSSURVEY.COM



VICINITY MAP



SITE PLAN

SCALE: 1" = 40'

N

VERTICAL DATUM:
NAVD 88 (GEOID 2012A) BASED ON REAL TIME KINEMATIC CORRECTIONS FROM THE WASHINGTON STATE REFEREENCE NETWORK.

HORIZONTAL DATUM:
NAD 83 (2011)
WASHINGTON STATE PLAN COORDINATE SYSTEM, SOUTH ZONE, U.S. SURVEY FEET. BASED ON REAL TIME KINEMATIC CORRECTIONS FROM THE WASHINGTON STAT REFERENCE NETWORK.

PARKLANDS II		
PRELIMINARY APPLICATION		
MARCH 2026		
APPLICANT INFORMATION	OWNER INFORMATION	
MAS1A, LLC ATTN: JON ELLSWORTH 3405 NW MCMASTER DRIVE CAMAS, WA 98607 (360) 798 - 2400 JONELLSWORTH@GMAIL.COM	SAME AS APPLICANT	
APPLICANT REPRESENTATIVE INFORMATION		
SGA ENGINEERING, PLLC ATTN: SCOTT TAYLOR & NATE HORVATH 2005 BROADWAY STREET VANCOUVER, WA 98663 (360) 993 - 0911 STAYLOR@SGAENGINEERING.COM / NHORVATH@SGAENGINEERING.COM		
EXISTING SITE INFORMATION		
BEING A PORTION OF THE SOUTHWEST QUARTER OF SECTION 28, TOWNSHIP 2 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN.		
PARCEL NUMBER	986043913 & 986043914	
PARCEL ADDRESS	3815 & 3711 NW CAMAS MEADOWS DRIVE CAMAS, WASHINGTON 98607	
EXISTING USE	VACANT	
ZONING DESIGNATION	BUSINESS PARK (BP) & R1-15	
GROSS SITE AREA	3.25 AC	141,521 SF
TRANSIT ROUTES	NO TRANSIT ROUTES ARE NEAR THE PROJECT SITE	
EXISTING UTILITIES		
SEWER	CITY OF CAMAS	
WATER	CITY OF CAMAS	
ENVIRONMENTAL CONDITIONS		
THE PROJECT SITE HAD A SEPA DETERMINATION OF NONSIGNIFICANCE ON JAN. 12TH, 2016. NO FURTHER DETERMINATION NEEDED FOR THIS PROJECT APPLICATION.		
EXISTING CONDITIONS DISCLAIMER		
THE EXISTING CONDITIONS SHOWN ON THIS PLAN WERE OBTAINED FROM INFORMATION PROVIDED BY MGS SURVEYING. SGA ENGINEERING, PLLC DOES NOT GUARANTEE THE ACCURACY OF THIS INFORMATION.		
PROPOSED SITE INFORMATION		
PRIVATE 8 LOT SINGLE FAMILY DETACHED SHORT PLAT WITH A PUBLIC PARK.		
DEVELOPMENT STANDARDS		
	ALLOWED	PROPOSED
MIN. LOT SIZE	8,000 SF	
MIN. LOT WIDTH	80 FT.	
MIN. LOT DEPTH	90 FT.	
FRONT SETBACK	15 FT. / 20 FT.	
STREET SIDE SETBACK	10 FT.	
INT. SIDE SETBACK	5 FT.	
REAR SETBACK	5 FT.	
LOT COVERAGE	50%	
BUILDING HEIGHT	35 FT.	
MAX. DENSITY	2.9	
UTILITY PROVIDERS		
SEWER		
WATER		
STORMWATER MANAGEMENT		
TREATMENT	STORMWATER WILL BE CAPTURED AND TREATED USING BIO-RETENTION FACILITIES OR OTHER APPROVED BMPS.	
DISPOSAL	STORMWATER WILL BE INFILTRATED INTO THE GROUND WHERE FEASIBLE OR DETAINED AND RELEASED AT OR BELOW PRE-DEVELOPED RATES.	
PROPOSED SITE AREA SUMMARY		
GROSS AREA	141,521 SF	3.25 AC
PRIVATE ROW	23,320 SF	0.54 AC
NET AREA	118,201 SF	2.71 AC
PARK TRACT	17,983 SF	0.41 AC
OPEN SPACE TRACT	4,818 SF	0.11 AC
TOTAL LOT AREA	95,400 SF	2.19 AC
AVERAGE LOT AREA	11,925 SF	0.27 AC

SHEET INDEX

SHEET	DESCRIPTION
PRE1.0	COVER SHEET
PRE2.0	EXISTING CONDITIONS
PRE3.0	PRELIMINARY GRADING & EROSION CONTROL PLAN
PRE4.0	PRELIMINARY STREET AND STORM PLAN
PRE5.0	PRELIMINARY SANITARY & WATER PLAN
PRE5.1	PRELIMINARY SANITARY & WATER DETAILS
PRE6.0	PRELIMINARY LANDSCAPE PLAN
PRE7.0	PRELIMINARY PLAT & SITE PLAN

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LANDSCAPE ARCHITECTURE
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FAX (360)993-0912

JOE A. INTERMILL — STATE OF WASHINGTON — 54905 — REGISTERED PROFESSIONAL ENGINEER

COVER SHEET

PARKLANDS II SHORT PLAT

CITY OF CAMAS — WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 40'
	4/3/2026

JOB NUMBER: 2451

SHEET: PRE1.0

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STORM MH
RIM=199.15
IE 24"ADS SOUTHEAST=190.95
UNABLE TO ASBUILT INVERT SOUTHWEST

4' METAL FENCE
3.9' NORTH OF LINE

5' METAL FENCE
ON LINE

TRACT "A"

STORM MH
RIM=199.58
IE 24"ADS NORTHWEST=191.40
IE 24"ADS EAST=191.40

4' METAL FENCE
1.0' NORTH OF LINE

STORM MH
RIM=196.90
IE 24"ADS WEST=191.95

100' PACIFICORP EASEMENT
AS SHOWN ON "ESTATES AT THE
(311-924)

EX. STM
ESMT TO REMAIN

10' PRIVATE STORMWATER
EASEMENT PER
"ESTATES AT THE ARCHERY"
(311-924)

EX. STM
ESMT TO BE
RELOCATED

10' PRIVATE STORMWATER
EASEMENT PER "ESTATES AT THE ARCHERY"
(311-924)

10' PRIVATE STORMWATER
EASEMENT PER
"ESTATES AT THE ARCHERY"
(311-924)

CONC.
WALL

5' METAL FENCE
2.4' WEST OF LINE

10' PUBLIC TRAIL EASEMENT
EASEMENT PER "ESTATES AT THE
(311-924)

STORM MH
RIM=218.23
IE 10"ADS NORTHEAST=200.14
IE 10"ADS SOUTHEAST=200.10

NW PITTOCK
PLACE (P)

VESTCAPITAL FUND II LLC
AFN 6110842
43
23,778 S.F.

GRAVEL

STORM MH
RIM=218.70
IE 18"ADS NORTH=199.05
IE 12"ADS NORTHEAST=199.12
IE 10"ADS WEST=199.35
IE 18"ADS SOUTH=210.30

EX. STM
ESMT TO BE
RELOCATED

3' CHAINLINK FENCE

10' PRIVATE STORMWATER
EASEMENT PER "ESTATES AT THE ARCHERY"
(311-924)

VESTCAPITAL FUND II LLC
AFN 6110842
44
117,737 S.F.

STORM MH
RIM=215.63
IE 18"ADS NORTH=199.86
IE 18"ADS SOUTH=199.99
IE 12"ADS SOUTHEAST=204.8

5' METAL FENCE

ASPHALT

CONC.
BLOCK WALL

SIDEWALK

CATCH BASIN
GRATE=221.69
IE 12"ADS SOUTH=217.44

75' RIGHT OF WAY PER
AFN 5044375

3' CHAINLINK FENCE

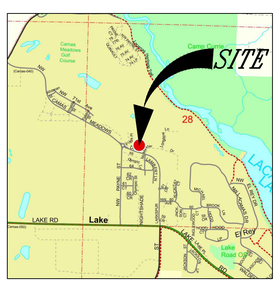
CURBLINE

NW CAMAS MEADOWS DR.

STORM MH
RIM=222.45
IE 18"ADS NORTH=214.48
IE 18"ADS EAST=214.64
IE 18"ADS SOUTHEAST=214.74
IE 18"ADS WEST=214.70

NW MCMASTER
DRIVE (P)

STORM MH
RIM=228.61
IE 18"ADS NORTH=220.01
IE 24"ADS SOUTH=220.08



VICINITY MAP
SCALE: NTS

N

0 30 60 90
Scale: 1" = 30'

PARKLANDS II

PRELIMINARY APPLICATION

MARCH 2026

APPLICANT INFORMATION	OWNER INFORMATION
MAS1A, LLC ATTN: JON ELLSWORTH 3405 NW MCMASTER DRIVE CAMAS, WA 98607 (360) 798 - 2400 JONELLSWORTH@GMAIL.COM	SAME AS APPLICANT

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SGA ENGINEERING, PLLC
ATTN: SCOTT TAYLOR & NATE HORVATH
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VANCOUVER, WA 98663
(360) 993 - 0911
STAYLOR@SGAENGINEERING.COM / NHORVATH@SGAENGINEERING.COM

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TRANSIT ROUTES	NO TRANSIT ROUTES ARE NEAR THE PROJECT SITE	

EXISTING UTILITIES

SEWER	CITY OF CAMAS
WATER	CITY OF CAMAS

ENVIRONMENTAL CONDITIONS

THE PROJECT SITE HAD A SEPA DETERMINATION OF NONSIGNIFICANCE ON JAN. 12TH, 2016. NO FURTHER DETERMINATION NEEDED FOR THIS PROJECT APPLICATION.

EXISTING CONDITIONS DISCLAIMER

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PRELIMINARY
NOT FOR CONSTRUCTION

EXISTING CONDITIONS

PARKLANDS II
SHORT PLAT

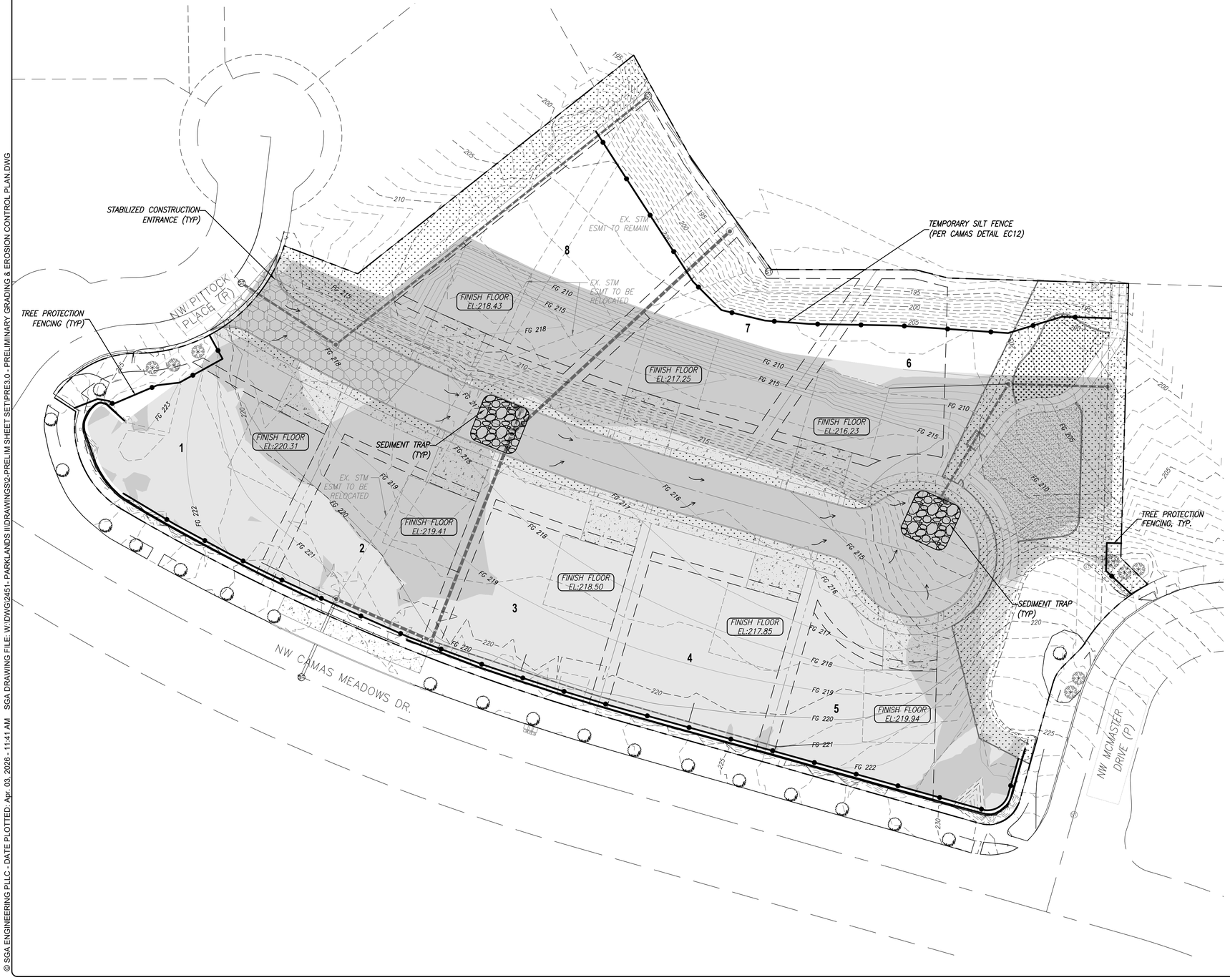
CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

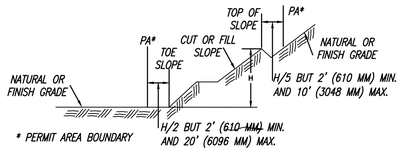
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DRAWN BY:	NDM
CHECKED BY:	JAI
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	4/3/2026
JOB NUMBER:	2451
SHEET:	PRE2.0

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LEGEND

- FILL AREA
- CUT AREA
- FG 100 — FINISHED GRADE CONTOURS
- 100 — EXISTING MAJOR CONTOURS
- TREES TO BE REMOVED
- STABILIZED CONSTRUCTION ENTRANCE (PER DETAIL EC6)
- TEMPORARY SEDIMENTATION TRAP (PER DETAIL E22)
- TEMPORARY SILT FENCE (PER DETAIL EC12)
- TEMPORARY STRAW WADDLES (PER DETAIL EC14)
- FLOW ARROW



NOTE: GRADING ACTIVITIES MUST BE AT LEAST TWO (2) FEET AWAY FROM PROPERTY BOUNDARIES

IBC APPENDIX J GRADING DETAIL

NO SCALE

DIRT QUANTITIES (CY)

ITEM	CUT	FILL
SITE GRADING	1,500	6,700
TRENCH SPOILS	TBD	---
IMPORT	5,200	---
TOTAL	6,700	6,700

1. ASSUMED 1.00' FOR SITE STRIPPINGS PER GEOTECH RECOMMENDATIONS ACTUAL CONDITIONS MAY VARY AND WILL EFFECT THE STRIPPING VOLUME.
2. EXCESS TRENCH SPOILS WILL BE STOCKPILED PRIOR TO BEING HAULED OFF SITE OR MAY BE USED AS STRUCTURAL FILL.
3. STRIPPINGS WILL BE STOCKPILED PRIOR TO BEING HAULED OFF SITE OR MAY BE USED NON-STRUCTURAL FILL.

QUANTITIES DO NOT ACCOUNT FOR SHRINK AND SWELL FACTORS. ACTUAL MATERIAL QUANTITIES MAY VARY PER SOIL TYPE, SOIL CONDITIONS, & CONSTRUCTION PRACTICES.

N

0 30 60 90

Scale: 1" = 30'

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FAX (360)993-0912

PRELIMINARY NOT FOR CONSTRUCTION — STATE OF WASHINGTON — JAMES I. ISAKSON — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY GRADING & EROSION CONTROL PLAN

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

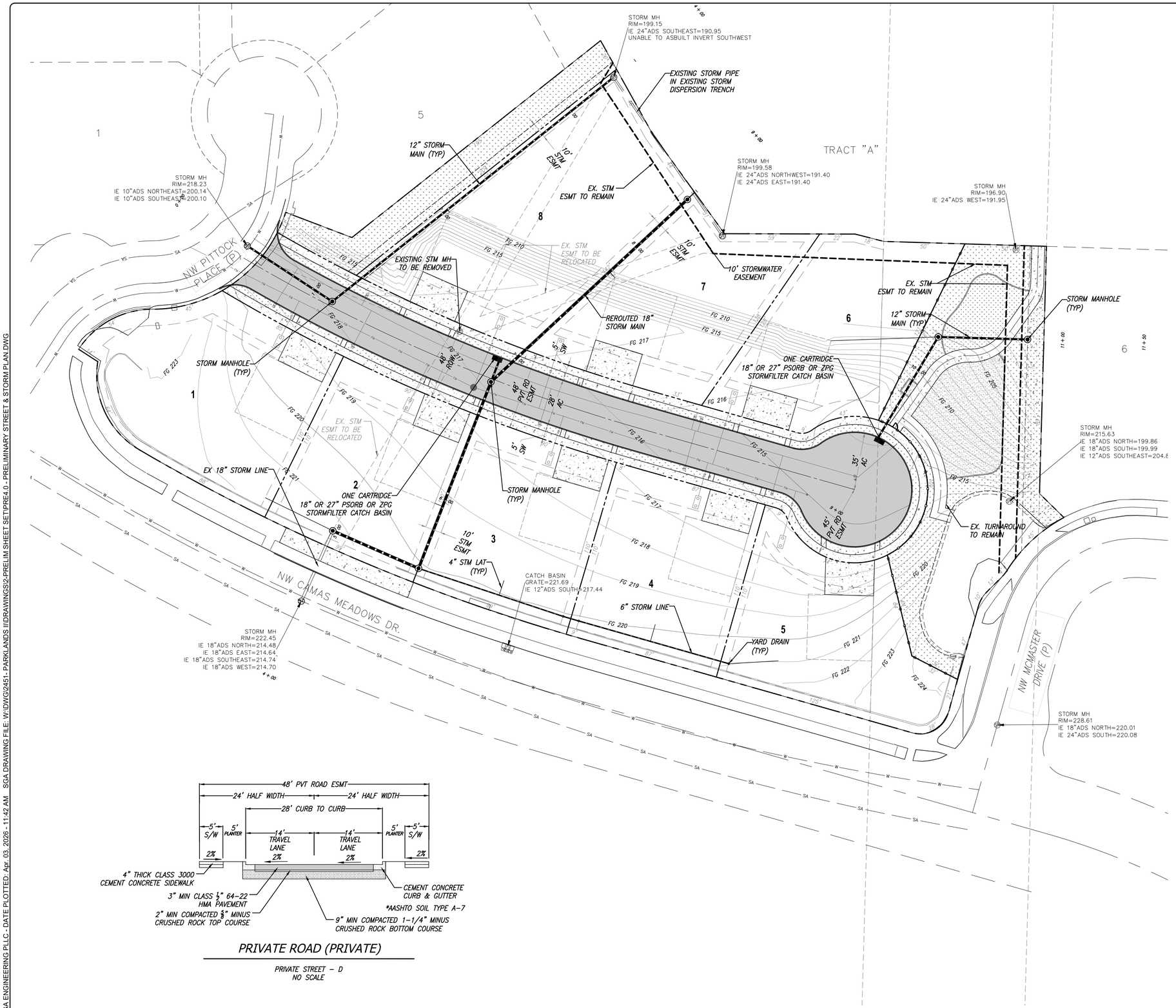
REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 30'
	4/3/2026

JOB NUMBER: 2451

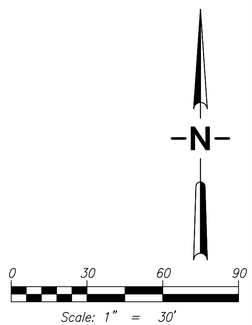
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PRIVATE ROAD (PRIVATE)

PRIVATE STREET - D
NO SCALE



Scale: 1" = 30'

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LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PRELIMINARY STREET & STORM PLAN

PARKLANDS II SHORT PLAT

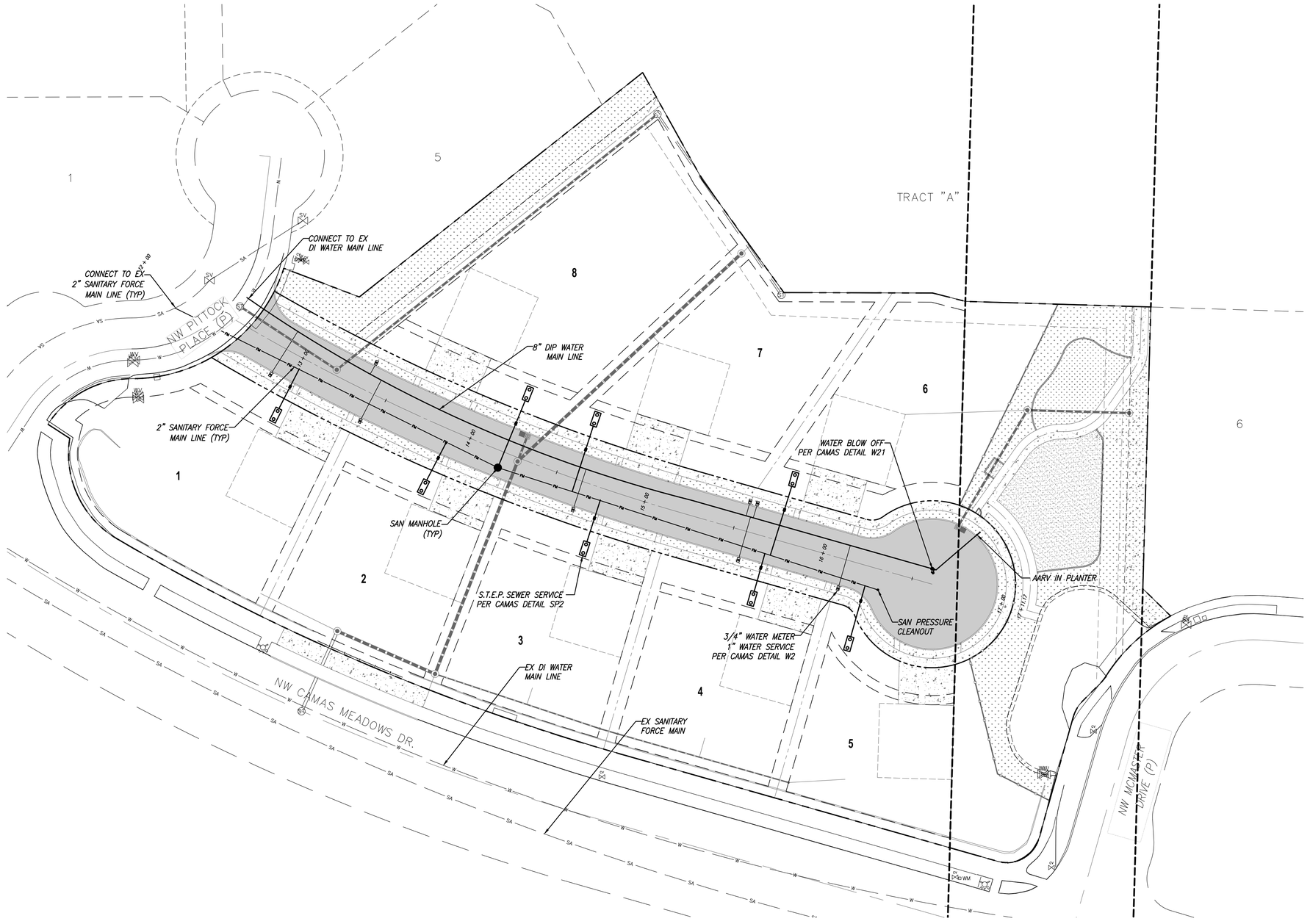
CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 30'
	4/3/2026
JOB NUMBER:	2451
SHEET:	PRE4.0

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Scale: 1" = 30'

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DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
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FAX (360)993-0912

PRELIMINARY SANITARY & WATER PLAN

PARKLANDS II SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

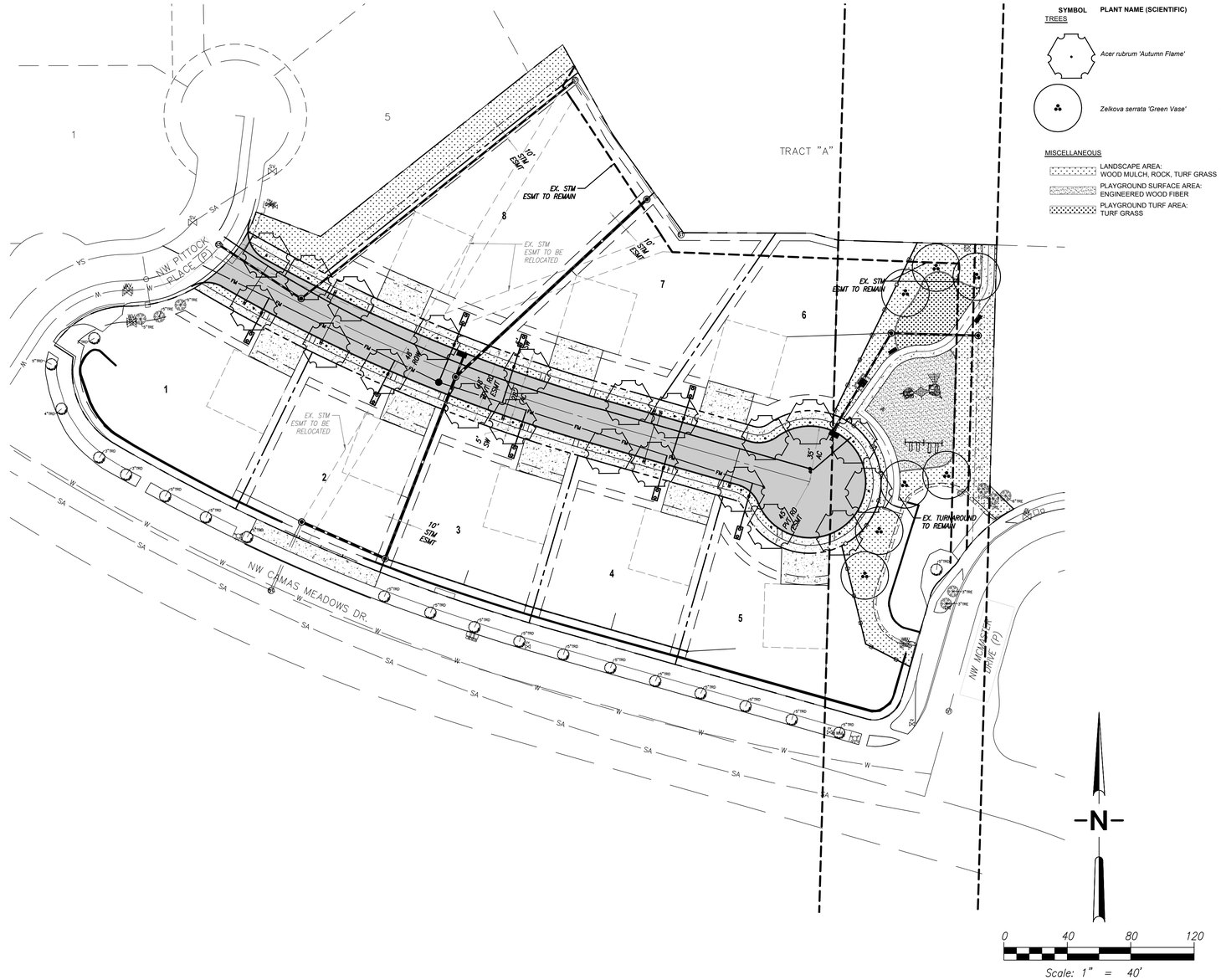
REVISIONS

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	4/3/2026

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PLANT LEGEND

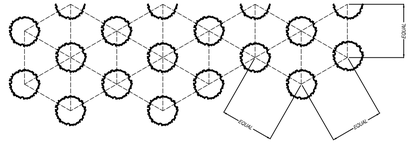
SYMBOL	PLANT NAME (SCIENTIFIC)	PLANT NAME (COMMON)	SIZE	SPACING	QUANTITY
TREES					
	Acer rubrum 'Autumn Flame'	Autumn Flame Maple	2" cal.	30' O.C.	21
	Zelkova serrata 'Green Vase'	Green Vase Zelkova	2" cal.	AS SHOWN	7

MISCELLANEOUS

LANDSCAPE AREA: WOOD MULCH, ROCK, TURF GRASS	15,385 SF
PLAYGROUND SURFACE AREA: ENGINEERED WOOD FIBER	3,013 SF
PLAYGROUND TURF AREA: TURF GRASS	1,493 SF

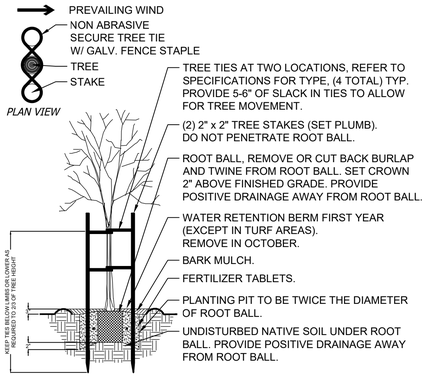
General Landscape Notes

1. Landscaping shall be watered with an irrigation system capable of sustaining all plantings in a healthy condition year-round.
2. Trees and other plantings shall be watered, pruned, fertilized, and maintained in a healthy condition.
3. Existing trees shall be protected from damage during and following construction.
4. Trees in the public right-of-way shall be installed by the developer or builder prior to issuance of the occupancy permit for the adjacent lot.
5. Trees on individual lots shall be installed by the developer or builder prior to issuance of the occupancy permit for that lot. Trees should not be installed until after driveways, sidewalks, and heavy construction activities are completed.
6. Approximate tree locations are shown on the plan; exact locations shall be determined by the developer or builder after construction of driveways, sidewalks, and buildings.
7. Long-term pruning and maintenance shall be performed by individual homeowners or the homeowner's association.
8. The contractor or builder shall be responsible for meeting soil quality and depth requirements (BMP T5.13) for all disturbed areas.
9. Proposed plant species may be substituted with equivalent species of similar size, form, and performance characteristics when approved by the landscape architect or reviewing authority.
10. Minimum plant sizes at installation shall be as follows:
    - Deciduous shade trees: minimum 2-inch caliper.
    - Evergreen trees: minimum 6-foot height.
    - Ornamental trees: minimum 1.5-inch caliper.
    - Shrubs: minimum 2-gallon container size.
    - Groundcovers/perennials: minimum 4-inch pots, spaced per plan.
11. All plant material installed by the developer or builder shall be warranted to remain alive and in healthy condition for a minimum period of one (1) year from the date of installation. Dead or declining plant material shall be replaced in kind.



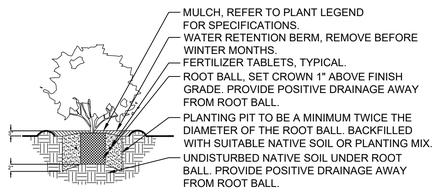
NOTES:
- All ground cover shall be planted at equal triangular spacing as specified in Planting Legend.
- Ground cover to be located one half of specified spacing distance from any hard surface, unless otherwise specified.
- Refer to all plan sheet specifications before bidding and constructing.

Typical Shrub Spacing NTS



NOT FOR USE IN WATER QUALITY AREAS

Typical Tree Planting NTS



Typical Shrub Planting NTS

SGA ENGINEERING & DESIGN
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DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PRELIMINARY NOT FOR CONSTRUCTION
STATE OF WASHINGTON
LICENSED
LANDSCAPE ARCHITECT
SCOTT A. TAYLOR
LICENSE NO. 1247
EXPIRES ON

PRELIMINARY LANDSCAPE PLAN

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

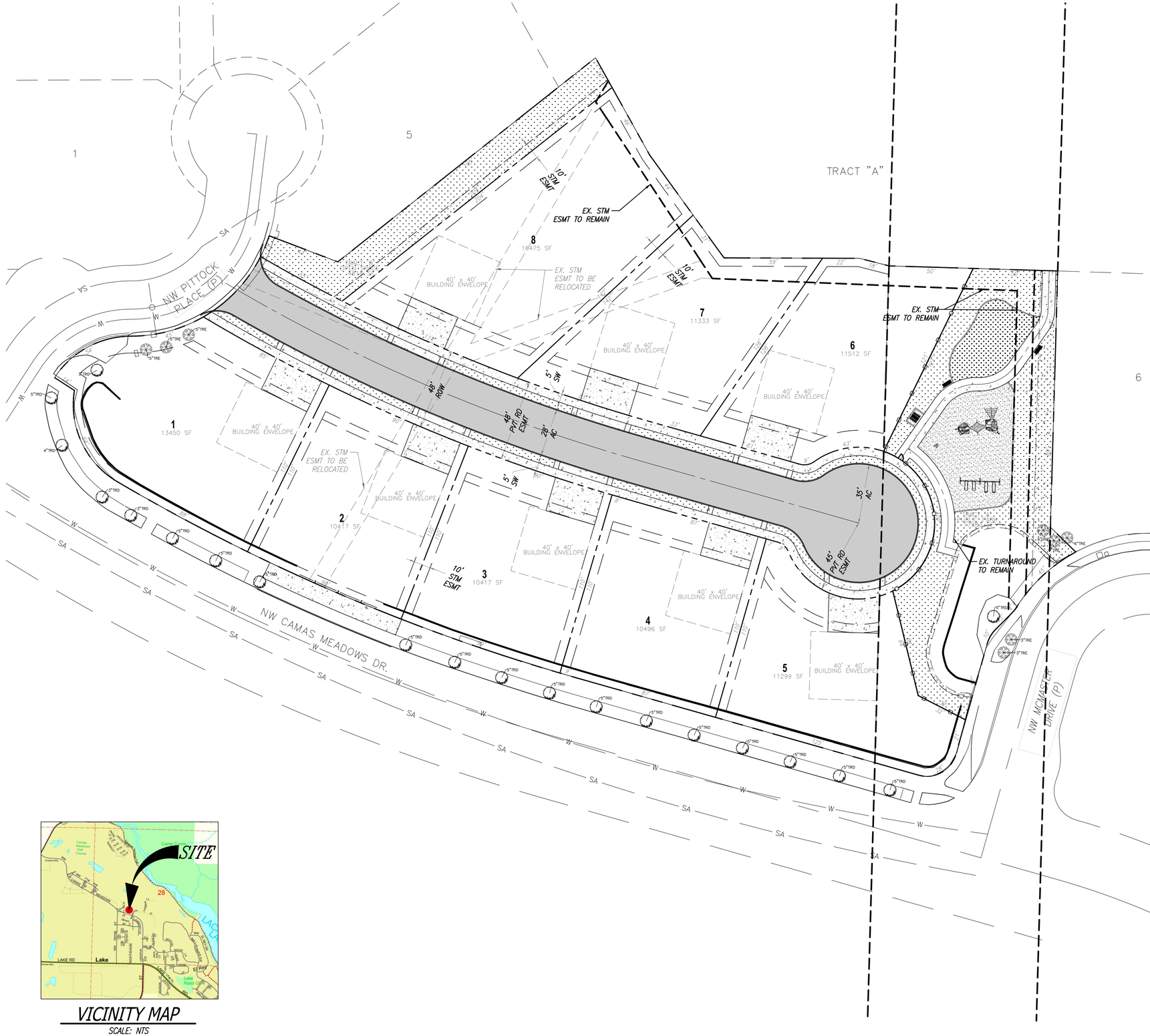
REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	#########
DATE:	4/3/2026

JOB NUMBER: 2451

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VICINITY MAP
SCALE: NTS

PARKLANDS II

PRELIMINARY APPLICATION

MARCH 2026

APPLICANT INFORMATION	OWNER INFORMATION
MAS1A, LLC ATTN: JON ELLSWORTH 3405 NW MCMASTER DRIVE CAMAS, WA 98607 (360) 798 - 2400 JONELLSWORTH@GMAIL.COM	SAME AS APPLICANT

APPLICANT REPRESENTATIVE INFORMATION

SGA ENGINEERING, PLLC
ATTN: SCOTT TAYLOR & NATE HORVATH
2005 BROADWAY STREET
VANCOUVER, WA 98663
(360) 993 - 0911
STAYLOR@SGAENGINEERING.COM / NHORVATH@SGAENGINEERING.COM

EXISTING SITE INFORMATION

BEING A PORTION OF THE SOUTHWEST QUARTER OF SECTION 28, TOWNSHIP 2 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN.

PARCEL NUMBER	986043913 & 986043914	
PARCEL ADDRESS	3815 & 3711 NW CAMAS MEADOWS DRIVE CAMAS, WASHINGTON 98607	
EXISTING USE	VACANT	
ZONING DESIGNATION	BUSINESS PARK (BP) & R1-15	
GROSS SITE AREA	3.25 AC	141,521 SF
TRANSIT ROUTES	NO TRANSIT ROUTES ARE NEAR THE PROJECT SITE	

EXISTING UTILITIES

SEWER	CITY OF CAMAS
WATER	CITY OF CAMAS

ENVIRONMENTAL CONDITIONS

THE PROJECT SITE HAD A SEPA DETERMINATION OF NONSIGNIFICANCE ON JAN. 12TH, 2016. NO FURTHER DETERMINATION NEEDED FOR THIS PROJECT APPLICATION.

EXISTING CONDITIONS DISCLAIMER

THE EXISTING CONDITIONS SHOWN ON THIS PLAN WERE OBTAINED FROM INFORMATION PROVIDED BY MGS SURVEYING. SGA ENGINEERING, PLLC DOES NOT GUARANTEE THE ACCURACY OF THIS INFORMATION.

PROPOSED SITE INFORMATION

PRIVATE 8 LOT SINGLE FAMILY DETACHED SHORT PLAT WITH A PUBLIC PARK.

DEVELOPMENT STANDARDS

	ALLOWED	PROPOSED
MIN. LOT SIZE	8,000 SF	
MIN. LOT WIDTH	80 FT.	
MIN. LOT DEPTH	90 FT.	
FRONT SETBACK	15 FT. / 20 FT.	
STREET SIDE SETBACK	10 FT.	
INT. SIDE SETBACK	5 FT.	
REAR SETBACK	5 FT.	
LOT COVERAGE	50%	
BUILDING HEIGHT	35 FT.	
MAX. DENSITY	2.9	

UTILITY PROVIDERS

SEWER	
WATER	

STORMWATER MANAGEMENT

TREATMENT	STORMWATER WILL BE CAPTURED AND TREATED USING BIO-RETENTION FACILITIES OR OTHER APPROVED BMPS.
DISPOSAL	STORMWATER WILL BE INFILTRATED INTO THE GROUND WHERE FEASIBLE OR DETAINED AND RELEASED AT OR BELOW PRE-DEVELOPED RATES.

PROPOSED SITE AREA SUMMARY

GROSS AREA	141,521 SF	3.25 AC
PRIVATE ROW	23,320 SF	0.54 AC
NET AREA	118,201 SF	2.71 AC
PARK TRACT	17,983 SF	0.41 AC
OPEN SPACE TRACT	4,818 SF	0.11 AC
TOTAL LOT AREA	95,400 SF	2.19 AC
AVERAGE LOT AREA	11,925 SF	0.27 AC

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DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PRELIMINARY PLAT & SITE PLAN

PARKLANDS II SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY: NDM
DRAWN BY: NDM
CHECKED BY: JAI
SCALE: 1" = 30'
4/3/2026

JOB NUMBER: 2451

SHEET: PRE7.0

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COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

April 30, 2026

Scott Taylor (staylor@sgaengineering.com)
Nate Horvath (nhorvath@sgaengineering.com)
SGA Engineering
2005 Broadway Street
Vancouver, WA 98683

RE: Parklands II Short Plat (SP26-1005) application completeness review letter

Dear Mr. Taylor and Mr. Horvath,

Thank you for your application submittal for the Parklands II Short Plat. There are items that remain to be addressed with your application. The purpose of this letter is to inform you that the above application submitted on April 3, 2026, has been deemed incomplete in accordance with Camas Municipal Code (CMC) Section 18.55.130. You have 180 days from the date of application to submit the missing information pursuant to CMC 18.55.130.C. If the below requested information is submitted, staff will again verify whether the application is complete.

Items necessary for completeness:

1. A plat alteration application shall be submitted and fees paid. Please see email correspondence below from the Community Development Director-

From: Alan Peters <APeters@cityofcamas.us>
Sent: Friday, August 22, 2025 8:41 AM
To: Eric Golemo <egolemo@sgaengineering.com>; 'Jon Ellsworth' <jonellsworthre@gmail.com>
Cc: 'Scott Taylor' <staylor@sgaengineering.com>
Subject: RE: Pre-application follow up (Short Plat on Camas Meadows Dr.)

Hi all,
Sorry for the late response to this. I had a vacation and then this got lost in the mix of thigs to reply to. I've discussed with engineering and planning staff and we are okay to accept this as a consolidated review, making the plat alteration and new short plat a single Type III process. The new short plat would not record until the storm reconfiguration is constructed.

Alan Peters, AICP
Community Development Director
Cell 360-409-1475
Desk 360-817-7254
www.cityofcamas.us | apeters@cityofcamas.us

2. Per the pre application meeting notes and CMC 18.55.110.C, provide certified mailing labels from the Clark County assessor.
3. Per the pre application meeting notes, a development sign must be posted per CMC 18.55.110.H(1-5). Provide proof of posting the development sign.
4. Per CMC 18.55.110.I, provide a copy of a full title report.
5. Per CMC 17.09.030.B.5 (a-q), the following shall be included on the site and development plans:
   a. A plat meeting the standards identified in CMC Section 17.01.050,
      - A.4- Provide legal description of boundaries

- B.2- Tracts to be dedicated to any public or private purpose shall be distinguished from lots intended for general development with notes stating their purpose and any limitations.
    - Label the open space and park tracts- i.e. what is the purpose of the open space tract?
- B.3- The plat shall also include identification of required setbacks.
    - A 15-foot front yard setback shall be shown on Lot 6 at the cul-de-sac.
    - Show rear yard setback at 15-feet per the Master Plan. Lots 1-5 are double frontage. Submit deviation requirement to vary from the double frontage setback requirements in CMC 17.19.030.D.6. Refer to Section 4.2 of DA.

b. The names of property owners of adjacent land and adjacent subdivisions shall be shown on the plat.

c. Lines marking the boundaries of the existing lots(s) (any existing lot to be eliminated should be a dashed line and so noted.
- Lot 43 needs to reflect this.

f. Location of existing and proposed sidewalk, street lighting and street trees.
- Street lighting needs to be shown on the preliminary plat.
- Per the pre application meeting notes and Section 4.2 of the DA, street trees shall be shown in the backyards of Lots 1-5.

j. Provided recorded documents that identify the nature and extent of existing easements.

m. Location of any critical areas and critical area buffers to indicate compliance with all applicable provisions of the critical areas legislation
- Show location of steep slopes if applicable.

o. Show location of all fire hydrants within five hundred feet of the proposal.
- There appears to be an existing hydrant on NW Camas Meadows Drive but not called out on the existing conditions sheet.
- An onsite hydrant will be required.

6. Per CMC 17.09.030.B.7, Preliminary stormwater plan and preliminary stormwater technical information (TIR).
    - The preliminary stormwater report does not reference which version of Ecology's SWMMWW Manual. It does reference that prepared using the Camas Stormwater Design Standards Manual, which was removed from the city website in 2018. The preliminary TIR is to be revised and prepared in accordance with the 2024 SWMMWW
7. Per CMC 17.09.030.B.8 and the pre-application meeting notes, a preliminary geotechnical report shall be submitted. The submitted preliminary geotechnical report is dated 2015. Geotechnical reports are valid for five years per CMC 16.59.060.D. Therefore, either an updated geotechnical report or memo shall be provided (prepared by a geotechnical engineer) to also include an assessment of potential geologically hazardous areas.
8. Per CMC 17.09.030.B.9 and the pre-application meeting notes, the narrative shall also address the criteria of preliminary short plat approval in CMC 17.09.030.D (1-9).

Once the application is deemed complete, the City will begin its review of the project application and provide subsequent review comments. If you have any questions, please contact me at lhollenbeck@cityofcamas.us.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck
Senior Planner

COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

June 24, 2026

Scott Taylor (staylor@sgaengineering.com)
Nate Horvath (nhorvath@sgaengineering.com)
SGA Engineering
2005 Broadway Street
Vancouver, WA 98683

RE: Parklands II short plat (SP26-1004) 2nd application completeness review and Plat Alteration (PlatAlt26-1001)

Dear Mr. Taylor and Mr. Horvath,

Thank you for your application resubmittal for the Parklands II short plat development. There are items that remain to be addressed with your application. The purpose of this letter is to inform you that the above application submitted on April 3, 2026, and resubmitted June 10, 2026, has been deemed incomplete in accordance with Camas Municipal Code (CMC) Section 18.55.130. You have 180 days from the date of application to submit the missing information pursuant to CMC 18.55.130.C. If the below requested information is submitted, staff will again verify whether the application is complete.

Items necessary for completeness:

Plat Alteration:

1. Per CMC 18.55.270.E, Plat alterations are processed pursuant to RCW 58.17.215, which requires that the application contain signatures of the majority of those persons having ownership interest of lots, tracts, parcels, sites, or divisions in the subject subdivision or portion to be altered.
    - Provide property owner signatures per this requirement.

Short Plat:

2. Per CMC 17.09.030.B.5 (a-q), the following shall be included on the site and development plans:
    a. A plat meeting the standards identified in CMC Section 17.01.050,
        - A.4- Provide legal description of boundaries
        - B.2- Tracts to be dedicated to any public or private purpose shall be distinguished from lots intended for general development with notes stating their purpose and any limitations.
            - Label the open space and park tracts
    f. Location of existing and proposed sidewalk, street lighting and street trees.
        - Street lighting needs to be shown on the preliminary plat- please label or add to legend.
    j. Provide recorded documents that identify the nature and extent of existing easements.
3. CMC 17.09.030.7 – Preliminary stormwater plan and preliminary technical information report (TIR).
    - The storm utility layer appears to be turned off.
4. Per CMC 17.09.030.B.9 and the pre-application meeting notes, the narrative shall also address the criteria of preliminary short plat approval in CMC 17.09.030.D (1-9).

Once the application is deemed complete, the City will begin its review of the project application and may provide subsequent comments. If you have any questions, please contact me at lhollenbeck@cityofcamas.us.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck
Senior Planner

COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

June 24, 2026

Scott Taylor (staylor@sgaengineering.com)
Nate Horvath (nhorvath@sgaengineering.com)
SGA Engineering
2005 Broadway Street
Vancouver, WA 98683

SGA RESPONSES IN GREEN

RE: Parklands II short plat (SP26-1004) 2nd application completeness review and Plat Alteration (PlatAlt26-1001)

Dear Mr. Taylor and Mr. Horvath,

Thank you for your application resubmittal for the Parklands II short plat development. There are items that remain to be addressed with your application. The purpose of this letter is to inform you that the above application submitted on April 3, 2026, and resubmitted June 10, 2026, has been deemed incomplete in accordance with Camas Municipal Code (CMC) Section 18.55.130. You have 180 days from the date of application to submit the missing information pursuant to CMC 18.55.130.C. If the below requested information is submitted, staff will again verify whether the application is complete.

Items necessary for completeness:

Plat Alteration:

1. Per CMC 18.55.270.E, Plat alterations are processed pursuant to RCW 58.17.215, which requires that the application contain signatures of the majority of those persons having ownership interest of lots, tracts, parcels, sites, or divisions in the subject subdivision or portion to be altered.
    - Provide property owner signatures per this requirement. **Confirmed not necessary as private storm tracts will be maintained by private HOA.**

Short Plat:

2. Per CMC 17.09.030.B.5 (a-q), the following shall be included on the site and development plans:
    a. A plat meeting the standards identified in CMC Section 17.01.050,
        - A.4- Provide legal description of boundaries **Plans updated.**
        - B.2- Tracts to be dedicated to any public or private purpose shall be distinguished from lots intended for general development with notes stating their purpose and any limitations.
            - Label the open space and park tracts **Plans updated.**

    f. Location of existing and proposed sidewalk, street lighting and street trees.
        - Street lighting needs to be shown on the preliminary plat- please label or add to legend. **Plans updated.**

    j. Provide recorded documents that identify the nature and extent of existing easements.

3. CMC 17.09.030.7 – Preliminary stormwater plan and preliminary technical information report (TIR).
    - The storm utility layer appears to be turned off. **Plans updated.**

4. Per CMC 17.09.030.B.9 and the pre-application meeting notes, the narrative shall also address the criteria of preliminary short plat approval in CMC 17.09.030.D (1-9). **Section 4.7 of narrative has been updated to cite and describe each criterion being met.**

Once the application is deemed complete, the City will begin its review of the project application and may provide subsequent comments. If you have any questions, please contact me at lhollenbeck@cityofcamas.us.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck
Senior Planner

COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

July 27, 2026

Scott Taylor (staylor@sgaengineering.com)
Nate Horvath (nhorvath@sgaengineering.com)
SGA Engineering
2005 Broadway Street
Vancouver, WA 98683

RE: Parklands II short plat (SP26-1005) and Plat Alteration (PlatAlt26-1001) technically complete review

Dear Mr. Taylor and Mr. Horvath,

The purpose of this letter is to inform you that the above application resubmitted on July 14, 2026, has been **deemed complete** in accordance with the Camas Municipal Code (CMC) Section 18.55.130.

Please note that the plat alteration application does not need to include signatures of persons having interest in the subdivision proposed to be altered pursuant to RCW 58.17.215 as Article VIII Section 5 of the recorded CC&R's for the Parklands subdivision gives the City of Camas authority to approve modifications to the stormwater easements.

Staff will begin reviewing the application and contact you with review comments and/or questions. Do not hesitate to reach out should you have any questions.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck, Senior Planner

Report of Geotechnical Engineering Services

Parklands II Short Plat

Camas, Washington

June 9, 2026

Geotechnical ■ Environmental ■ Special Inspections

Columbia West
Engineering, Inc



Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

Vancouver, Washington • Phone: 360-823-2900
Portland, Oregon • Phone: 971-384-1666
www.columbia-west.com

June 9, 2026

MAS1A LLC
3405 NW McMaster Drive
Camas, WA 98607

Attn: Jon Ellsworth

Re: Report of Geotechnical Engineering Services
Parklands II Short Plat
NW Camas Meadows Drive
Camas, Washington
CWE Project: MAS1A-1-01-1

Columbia West Engineering, Inc. (Columbia West) is pleased to present this report of geotechnical engineering services for the proposed Parklands II Short Plat project in Camas, Washington. Our services were conducted in accordance with our proposal dated May 14, 2026.

We appreciate the opportunity to be of services on this project. Please contact us if you have any questions regarding this report.

Sincerely,

Michael C. King, PE
Senior Project Engineer

Daniel E. Lehto, PE, GE
Principal Engineer



Signed 06/09/2026

MCK:DEL:kat
Attachments
Document ID: MAS1A-1-01-1-060926-geor.docx

EXECUTIVE SUMMARY

This section provides a summary of the geotechnical considerations associated with the proposed Parklands II Short Plat project in Camas, Washington. This summary is an overview and the report should be referenced for a thorough discussion of subsurface conditions and geotechnical recommendations for the project.

- The proposed lightly loaded residential structures can be supported by conventional spread footings bearing on firm soil as described in the report.

- The on-site soil will generally provide poor support for construction equipment during the wet construction season. Subgrade protection during construction will be important. Granular haul roads and working pads should be employed if earthwork occurs during the wet season or when the subgrade is wet of optimum moisture content. Extended wet weather construction may significantly affect earthwork productivity and increase the need for imported stabilization material.

- Partially cemented sandstone was encountered as shallow as approximately 3 feet BGS in test pit TP-4 and exhibited increased excavation resistance compared to the surrounding soil. In addition, conglomerate deposits are mapped in the site vicinity and may be encountered at shallow depths across portions of the site. Excavation difficulty may increase where cemented sandstone or conglomerate deposits are encountered, and specialized excavation methods may be required in localized areas.

- Permanent slopes should not be constructed steeper than 2H:1V. Foundations located above slope crests should maintain a minimum 10-foot horizontal setback measured from the outside edge of the foundation to the face of the slope.

- Due to the sloping topography and fine-grained soil encountered at the site, foundation drains are recommended for structures at the site.

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ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
AOS	apparent opening size
ASCE	American Society of Civil Engineers
ASTM	ASTM International
BGS	below ground surface
CSZ	Cascadia Subduction Zone
ESAL	equivalent single axle load
g	gravitational acceleration (32.2 feet/second^2)
HDPE	high-density polyethylene
HMA	hot mix asphalt
H:V	horizontal to vertical
IBC	International Building Code
km	kilometer(s)
MCE	maximum considered earthquake
M_W	moment magnitude
OSHA	Occupational Safety and Health Administration
pcf	pounds per cubic foot
pci	pounds per cubic inch
PG	performance grade
psf	pounds per square foot
psi	pounds per square inch
PVC	polyvinyl chloride
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WSS	Washington Standard Specifications for Road, Bridge, and Municipal Construction (2026)

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
PARKLANDS II SHORT PLAT
CAMAS, WASHINGTON

1.0 INTRODUCTION

Columbia West is pleased to submit this geotechnical engineering report for the proposed Parklands II Short Plat project in Camas, Washington. The 3.25-acre site is located east of the intersection of NW Camas Meadows Drive and NW Pittock Place. The site is shown relative to surrounding physical features on Figure 1. Existing site conditions are shown on Figure 2. Abbreviations and acronyms used herein are defined immediately following the Table of Contents.

The project includes subdividing the parcel to support up to eight single-family residential building lots. Improvements are also expected to consist of utility infrastructure, public and private AC-paved roadways, and stormwater management facilities. Based on the existing site topography and correspondence with the design team, we expect the site will be graded to support terraced development and cuts and fills on the order of approximately 5 feet each are anticipated. We estimate column and wall loads will not exceed 20 kips and 4 kips per lineal foot, respectively. Slab loads are not expected to exceed 100 psf.

2.0 BACKGROUND

In 2015, Columbia West performed geotechnical engineering services for the Parklands at Camas Meadows development and prepared a geotechnical report (Columbia West 2015). At that time, the development plan consisted of detached single-family residential lots and commercial parcels located along the NW Camas Meadows Drive frontage.

Site development, including mass grading, utility installation, roadway construction, and preparation of the commercial parcels, were completed between 2017 and 2018. Columbia West provided construction observation and testing services during portions of site development and documented the completed grading and earthwork operations within the project area.

Based on Columbia West's understanding, the commercial parcels have remained substantially unchanged since completion of site development. Significant grading, construction, or other site alterations within the subject parcels have not been identified since the original infrastructure improvements were completed.

The current exploration program was performed to evaluate whether subsurface conditions within the subject parcels remain generally consistent with those observed during the previous geotechnical study and prior site development.

3.0 PURPOSE AND SCOPE

The purpose of our services was to provide geotechnical engineering recommendations for the proposed project. The specific scope of our services included the following:

- Reviewed information provided and available in Columbia West's files for the site vicinity.
- Coordinated and managed the field exploration program, which included locating utilities, coordinating site access, and scheduling subcontractors and Columbia West field staff.
- Conducted a subsurface exploration program that included the following:
  - Excavated six test pits to depths between 7 and 12 feet BGS
- Collected soil samples from the explorations and maintained a log of subsurface conditions encountered.
- Prepared this geotechnical engineering report that summarizes our explorations and analyses and provides geotechnical design criteria and construction recommendations for the proposed development, which includes the following:
  - Summary of subsurface conditions at the site
  - Exploration logs
  - Recommendations for foundation support
  - Recommendations for floor slab subgrade preparation
  - Recommendations for retaining walls, including lateral earth pressures, backfill, compaction, and drainage
  - Recommendations for site preparation, including grading and drainage, stripping depths, fill type for imported material, compaction criteria, trench excavation and backfill, use of on-site soil, and wet/dry weather earthwork
  - Recommendations for managing groundwater conditions that may affect the performance of structures and site improvements
  - Recommendations for pavement design and construction
  - Seismic design coefficients in accordance with the 2021 IBC

4.0 SITE CONDITIONS

4.1 GEOLOGY

The site is located 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 Puget Sound Lowland constitute highland areas, and depressed structural zones form sediment-filled basins. The site is located in the east portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

The near-surface geologic units mapped across the site include gravel facies (Qfg), hyaloclastite sandstone (Tfth), and conglomerate (QTc). The Qfg unit generally consists of unconsolidated to weakly cemented gravelly deposits containing sand, gravel, cobbles, and occasional boulders. The Tfth unit consists of sandstone and conglomeratic deposits derived primarily from basaltic volcanic debris and commonly includes dense to very dense sand and gravel with occasional cemented zones. The QTc unit consists of unconsolidated to semi-consolidated pebble- to boulder-sized conglomerate with a sandy matrix. These geologic units are generally characterized by variable cementation, weathering, excavation conditions, and groundwater occurrence and may result in significant variation in subsurface conditions across the site.

The Web Soil Survey identifies the site as being predominantly underlain by Hesson clay loam (USDA 2026). These mapped soils generally consist of fine-grained silty clay loam to clay loam deposits derived from weathered volcanic materials. Hesson soils commonly exhibit moderate to high fines content and are generally consistent with the fine-grained soil encountered during our field explorations.

4.2 SURFACE CONDITIONS

The 3.25-acre site is generally open and grassy, remaining in its apparent post-construction condition. Site terrain is generally gently sloped with engineered north-facing slopes traversing portions of the central and north areas of the site. The site is bounded by NW Camas Meadows Drive to the south, forested land to the north, and residential development to the east and west.

4.3 SUBSURFACE CONDITIONS

4.3.1 General

Subsurface conditions at the site were explored by excavating six test pits (TP-1 through TP-6) to depths between 7 and 12 feet BGS. The exploration locations are shown on Figure 2. A description of our field exploration program and the exploration logs are presented in Appendix A. A summary of the subsurface conditions is presented below.

4.3.2 Soil Conditions

4.3.2.1 Topsoil and Root Zone

The surficial layer of soil covering the majority of the site consists of grass roots and a topsoil zone. The topsoil zone is generally 6 inches thick and consists of silty gravel with trace organics and variable proportions of cobbles. The root zone is generally 4 inches thick.

4.3.2.2 Engineered Fill

Engineered structural fill was observed below the topsoil layer in all test pit locations. The fill observed generally consists of silty gravel with variable proportions of cobbles and organics. The fill observed appeared generally consistent with the engineered structural fill observed and tested during prior site development.

4.3.2.3 Native Soil

Native soil encountered during our explorations generally consists of fine-grained and granular soils consistent with the mapped geologic units in the site vicinity. The observed subsurface conditions were generally consistent with soil encountered during the previous geotechnical investigation and those observed during prior site development completed between 2017 and 2018.

4.3.3 Groundwater

Perched groundwater seepage was observed in test pit TP-2 at a depth of 5 feet BGS. The observed rate of seepage was slow to moderate. Localized perched groundwater conditions may be present within discontinuous zones where relatively permeable soil overlies lower permeability soil. Groundwater levels are often subject to seasonal variation and may rise during extended periods of increased precipitation.

4.4 SEISMIC HAZARDS

4.4.1 Seismic Setting

4.4.1.1 Earthquake Sources

Three scenario earthquakes were considered for this study consistent with the local seismic setting. Two of the possible earthquake sources are associated with the CSZ, and the third event is a shallow, local crustal earthquake that could occur in the North American Plate. The three earthquake scenarios are discussed below.

4.4.1.2 Regional Events

The CSZ is the region where the Juan de Fuca Plate is being subducted beneath the North American Plate. This subduction is occurring in the coastal region between Vancouver Island and northern California. Evidence has accumulated suggesting that this subduction zone has generated eight great earthquakes in the last 4,000 years, with the most recent event occurring approximately 300 years ago (Weaver and Shedlock 1991). The fault trace is mapped approximately 50 to 120 km off the Washington Coast.

Two types of subduction zone earthquakes are possible and considered in this study:

- An interface event earthquake on the seismogenic part of the interface between the Juan de Fuca Plate and the North American Plate on the CSZ. This source is capable of generating earthquakes with a M_W of 9.0+.
- A deep intraplate earthquake on the seismogenic part of the subducting Juan de Fuca Plate. These events typically occur at depths of between 30 and 60 km. This source is capable of generating an event with a M_W of up to 8.0.

4.4.1.3 Local Events

A significant earthquake could occur on a local fault near the site within the design life of the development. Such an event would cause ground shaking at the site that could be more intense than the CSZ events, although the duration would be shorter. Table 1 provides information on local faults close to the site.

Table 1. Nearest Mapped Crustal Faults

Source	Closest Mapped Distance[1] (km)	Mapped Length[1] (km)
Lacamas Lake fault	0.7	24
Grant Butte fault	14	10
East Bank fault	19	29
Portland Hills fault	21	49

1. Based on mapping by USGS (2026)

4.4.2 Seismic Settlement

Liquefaction is caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles. Granular soil, which relies on interparticle friction for strength, undergoes a loss of strength until the excess pore pressures dissipate. In general, loose, saturated sand soil

with low silt and clay content is the most susceptible to liquefaction. Silty soil with low plasticity can be susceptible to strain softening under relatively higher levels of ground shaking. Strain-softened soil has volumetric strains much smaller than liquefiable soil due to matrix effects. Based on the results of our subsurface explorations and review of groundwater mapping, liquefaction is not considered a hazard at the site.

4.4.3 Lateral Spreading

Lateral spreading is a liquefaction-related seismic hazard and occurs on gently sloping or flat sites underlain by liquefiable sediment adjacent to an open face, such as a riverbank. Liquefied soil adjacent to an open face can flow toward the open face, resulting in lateral ground displacement. Due to the low risk for liquefaction potential at the site, lateral spreading is not considered a hazard at the site.

5.0 DESIGN

Based on our subsurface explorations and analysis, the proposed development is generally compatible with the surface and subsurface soil, provided the recommendations presented in this report are incorporated into design and implemented during construction.

5.1 SHALLOW FOUNDATION SUPPORT

Based on the foundation loads in Section 1.0 (Introduction), the proposed buildings can be supported by conventional spread footings bearing on firm native soil or engineered structural fill underlain by firm native soil.

Foundations should not be supported by topsoil/buried topsoil or undocumented fill material. If encountered, these materials should be removed and replaced with structural fill/granular pads. If footings are constructed during wet weather conditions or when the footing subgrade soil is above its optimum moisture content, we recommend placing and compacting a thin layer of crushed rock (typically 2 to 4 inches) meeting the requirements for imported granular material described in Section 6.6.1 (Structural Fill) over the exposed subgrade soil.

5.1.1 Dimensions and Capacity

Continuous perimeter wall and isolated spread footings should have minimum widths of 16 and 20 inches, respectively. The bases of exterior footings should bear at least 18 inches below the lowest adjacent exterior grade. The bases of interior footings should bear at least 12 inches below the base of the floor slab.

Footings bearing on subgrade prepared as recommended above should be sized based on an allowable bearing pressure of 2,000 psf. As the allowable bearing pressure is a net bearing pressure, the weight of the footing and associated backfill may be ignored when calculating footing sizes. The recommended allowable bearing pressure applies to the total of dead plus long-term live loads and is typically increased by one-third for transient lateral forces such as seismic or wind.

5.1.2 Static Settlement

Foundation settlement is a significant structural design consideration and will primarily be controlled by site grading and floor slab loading. Provided the subgrade soil is prepared as

described in Section 6.1 (Site Preparation), we anticipate total static foundation settlement will be less than approximately 1 inch. Differential settlement between comparably loaded footing elements is not expected to exceed approximately 0.5 inch over a span of 50 feet.

5.1.3 Resistance to Sliding

Lateral foundation loads can be resisted by passive earth pressure on the sides of footings and by friction at the bases of footings. Our analysis indicates the available passive earth pressure for footings confined by native soil or engineered structural fill is 300 pcf. Typically, the movement required to develop the available passive resistance may be relatively large; therefore, we recommend using a reduced passive equivalent fluid pressure of 250 pcf. The upper 12 inches of soil should be neglected when calculating passive pressure resistance. The recommended passive pressure resistance assumes that a minimum horizontal clearance of 10 feet is maintained between the footing face and the face of descending slopes and groundwater remains below the bases of footings.

The estimated unfactored coefficient of friction between in-situ native soil or engineered structural fill and in-place poured concrete is 0.35. The estimated unfactored coefficient of friction between compacted crushed aggregate and in-place poured concrete is 0.45.

5.1.4 Subgrade Observation

Footing subgrade soil should be evaluated by Columbia West prior to placing forms or reinforcing bar to verify subgrade support conditions are as anticipated in this report. Subgrade observation should confirm that all disturbed material, organic material, unsuitable fill, remnant topsoil zones, and softened subgrade (if present) have been removed. Over excavation of footing subgrade soil may be required to remove deleterious material, particularly if footings are constructed during wet weather conditions. Footing excavations should be backfilled with compacted granular pads.

5.1.5 Floor Slabs

Floor slabs can be supported on firm, competent native soil or engineered structural fill underlain by firm native soil prepared as described in this report. Disturbed soil and unsuitable fill in proposed slab locations (if encountered) should be removed and replaced with structural fill.

To reduce slab shifting and moisture transmission, slabs should be underlain by at least 6 inches of compacted crushed aggregate. Geotextile may be used below the crushed aggregate layer to increase subgrade support. Recommendations for floor slab aggregate base and subgrade geotextile are discussed in Section 6.6 (Materials).

Slab thickness and reinforcement should be designed by an experienced structural engineer in accordance with anticipated loads. Concrete floor slabs with maximum loads of 100 psf may be designed assuming a modulus of subgrade reaction, k, of 150 pci for slabs on grade constructed on subgrade prepared as recommended in this report.

Flooring manufacturers often require vapor barriers to protect flooring and flooring adhesives. Many flooring manufacturers will warrant their product only if a vapor barrier is installed according to their recommendations. Selection and design of an appropriate vapor barrier (if needed) should be based on discussions among members of the design team.

5.2 SEISMIC DESIGN CRITERIA

Seismic design for the proposed structures is governed by ASCE 7-16. Based on review of geologic mapping and the results of our subsurface explorations, seismic design parameters for Site Class D are presented for the site in Table 2.

Table 2. ASCE 7-16 Seismic Design Parameters[1]

Parameter	Short Period (T_s)	1-Second Period (T_1)
MCE spectral response acceleration, S	S_S = 0.807 g	S_1 = 0.353 g
Site class	D	
Site coefficient, F	F_a = 1.177	F_v = 1.94
Adjusted spectral response acceleration, S_M	S_{MS} = 0.950 g	S_{M1} = 0.694 g
Design spectral response acceleration, S_D	S_{DS} = 0.634 g	S_{D1} = 0.463 g

1. S_{M1} and S_{D1} must be increased by 50 percent per ASCE 7-16 Supplement 3 Section 11.4.8 Exception 1 or else a ground motion hazard analysis is required.

According to Section 11.4.8 of ASCE 7-16, a ground motion hazard analysis may be required to determine S_{D1}, unless seismic design parameters are determined in accordance with the exceptions defined in that section. Exception 1 of Supplement 3 to ASCE 7-16 indicates a ground motion analysis is not required for structures on Site Class D sites with S_1 greater than or equal to 0.2 where the S_{M1} and S_{D1} values are increased by 50 percent. Columbia West recommends the project structural engineer evaluate these requirements and exceptions to determine if the parameters for Site Class D provided in Table 2 can be used for design or if a site-specific seismic hazard evaluation is required.

5.3 PERMANENT SLOPES

Permanent cut and fill slopes should not exceed 2H:1V. Slopes that will be maintained by mowing and slopes that will be below the potential inundation depth for stormwater detention ponds should not be constructed steeper than 3H:1V. Access roads and pavement should be located at least 5 feet from the tops of cut and fill slopes. Foundations should maintain a minimum 10-foot horizontal setback measured from the outside edge of the foundation to the face of the slope. A minimum slope setback detail for structures is presented on Figure 3. The slopes should be planted with appropriate vegetation to provide protection against erosion as soon as possible after grading. Surface water runoff should be collected and directed away from slopes to prevent water from running down the slope face.

5.4 RETAINING STRUCTURES

5.4.1 General

Retaining walls may be constructed at the site. Our retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls, (2) the walls are less than 10 feet in height, (3) the backfill is drained, and (4) the wall contains level backfill. Re-evaluation of our recommendations will be required on a case-by-case basis if the retaining wall design criteria for the project varies from these assumptions.

5.4.2 Wall Design Parameters

Lateral earth pressures should be considered during design of retaining walls and below-grade structures. Hydrostatic pressure and additional surcharge loading should also be considered if applicable. Wall foundation construction and bearing capacity should adhere to the specifications in Section 5.1 (Shallow Foundation Support).

Permanent retaining walls that are not restrained from rotation, are drained, and are retaining undisturbed native soil should be designed for active earth pressures using an equivalent fluid pressure of 39 pcf. Walls retaining undisturbed native soil that are restrained from rotation should be designed for an at-rest equivalent fluid pressure of 64 pcf. For walls with imported well-drained granular backfill meeting the specifications in WSS 9-03.12(2) – Gravel Backfill for Walls, active and at-rest equivalent fluid pressures of 34 pcf and 54 pcf, respectively, are applicable.

Additional lateral earth pressures caused by surcharge loads (i.e., loads from construction, traffic, and adjacent structures) should be calculated based on the equations presented on Figure 4. Seismic lateral earth pressures for walls retaining level backfill may be calculated assuming an equivalent fluid weight of 13 pcf for walls free to rotate or 27 pcf for walls that are restrained against rotation. The result of the triangular distribution increasing with depth should be applied at a height of 0.34H above the base of the wall, where H is the wall height. The seismic earth pressure force should be superimposed with static active earth pressure.

5.4.3 Backfill and Drainage

The above design parameters have been provided assuming back-of-wall drains will be installed to prevent buildup of hydrostatic pressure behind all walls. If a drainage system is not installed, our office should be contacted for revised design forces.

A minimum 6-inch-diameter, perforated collector pipe should be placed at the bases of the walls. The pipe should be embedded in a minimum 2-foot-wide zone of angular drain rock that is wrapped in a drainage geotextile fabric and extends up the backs of the walls to within 1 foot of finished grade. The drain rock and drainage geotextile fabric should meet specifications in Section 6.6 (Materials). The perforated collector pipes should discharge at appropriate locations away from the bases of the walls. The discharge pipes should not be tied directly into stormwater drain systems, unless measures are taken to prevent backflow into the drainage systems of the walls.

Backfill placed behind the walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of retaining wall select backfill placed and compacted in conformance with Section 6.6.1 (Structural Fill).

Settlement of up to 1 percent of the wall height commonly occurs immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend construction of flatwork adjacent to retaining walls be postponed at least four weeks after backfilling the walls, unless survey data indicates that settlement is complete prior to that time.

5.5 DRAINAGE

5.5.1 Temporary

During work at the site, the contractor should be made responsible for temporary drainage of surface water as necessary to prevent standing water and/or erosion at the working surface. During rough and finished grading of the site, the contractor should keep all pads and subgrade free of ponding water.

5.5.2 Surface

The ground surfaces at finished pads should be sloped away from their edges at a minimum 2 percent gradient for a distance of at least 5 feet. Roof drainage from buildings should be directed into solid, smooth-walled drainage pipes that carry the collected water to the storm drain system.

5.5.3 Subdrains

Subdrains consisting of a trench backfilled with drain rock and a perforated pipe should also be considered if portions of the site are cut below surrounding grades. If encountered in cut areas, shallow groundwater, springs, or seeps should be conveyed via drainage channel or perforated pipe into 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 subsurface drainage may result in soil slumping or unanticipated settlement of structures exceeding tolerable limits. A typical perforated drainpipe trench detail is presented on Figure 5.

If site grading and improvements include cuts greater than 10 feet, there may be a greater potential of encountering subsurface seepage or springs, which may need to be captured and conveyed to an approved location as described above. Columbia West should be contacted to review site grading plans when cut and fill volumes and locations are determined.

If installed during site improvement activities, drains should be closely monitored after construction to assess their effectiveness. If additional surface or shallow subsurface seepage become evident, the drainage provisions may require modification or additional drains. Columbia West should be consulted to provide appropriate recommendations during and after construction if additional groundwater seepage become evident.

5.5.4 Foundation Drains

Due to the sloping topography and the potential for localized perched groundwater conditions within the fine-grained soil, perimeter building foundation drains should be considered for structures at the site. Foundation drains are generally not necessary on the down-slope sides of buildings constructed on slopes. Foundation drains should consist of a filter fabric-wrapped, drain rock-filled trench that extends at least 12 inches below the lowest adjacent grade (i.e., slab subgrade elevation). A perforated pipe should be placed at the base to collect water that gathers

in the drain rock. The drain rock and filter fabric should meet the specifications in Section 6.6 (Materials). Discharge for footing drains should not be tied directly into the stormwater drainage system, unless mechanisms are installed to prevent backflow.

5.6 PAVEMENT

5.6.1 General

We recommend that public roadways for the subdivision be constructed in accordance with City of Camas standards. Based on our explorations, an AASHTO soil classification of A-5 should be used for design of public roadways.

We have provided pavement sections for private automobile-only parking and drive aisles that may also service heavy vehicle traffic (i.e., garbage trucks, semi-trucks, etc.). Our pavement recommendations are based on the following design parameters and assumptions:

- The subgrade consists of firm, undisturbed native soil or a minimum of 12 inches of subgrade soil directly below the pavement sections are compacted to at least 92 percent of maximum dry density as determined by ASTM D1557.
- Resilient moduli for subgrade soil and aggregate base materials were assumed to be 4,000 psi and 20,000 psi, respectively.
- Pavement design life of 20 years with no expected traffic growth.
- Initial and terminal serviceability indices of 4.2 and 2.0, respectively.
- Structural coefficients of 0.42 and 0.10 for the AC and aggregate base, respectively.
- Reliability of 75 percent and standard deviation of 0.45.
- Truck traffic consists of two- and three-axle vehicles, such as delivery trucks.
- Pavement may be exposed to a fire apparatus load of 75,000 pounds on an infrequent basis.

If any of these assumptions are incorrect, Columbia West should be contacted with the appropriate information so that the pavement designs can be revised.

5.6.2 AC Pavement Design Sections

Based on the traffic assumptions stated above, we recommend the AC pavement sections presented in Table 3. Material properties and compaction recommendations for AC and aggregate base are presented in Section 6.6 (Materials).

Table 3. Recommended AC Pavement Sections Constructed over Native Soil or Engineered Fill

Traffic	ESALs	AC[1] (inches)	Aggregate Base[1] (inches)
Drive aisles with limited trucks (up to five trucks per day)	25,000	3	9
Automobile parking (no trucks)	5,000	2.5	8

1. All thicknesses are intended to be the minimum acceptable.

5.6.3 Construction Considerations

Recommended pavement section thicknesses are intended to be minimum acceptable values and do not include construction traffic loading. The recommendations assume that pavement construction will be completed during an extended period of warm, dry weather. Wet weather construction may require an increased thickness of aggregate base as discussed in Section 6.2 (Construction Traffic and Staging). Construction traffic should be limited to dedicated haul roads or non-structural, unpaved portions of the site. Construction traffic should not be permitted on new pavement, unless accounted for in the pavement design section.

6.0 CONSTRUCTION

6.1 SITE PREPARATION

6.1.1 General

Site grading should be performed in accordance with the requirements specified in the 2021 IBC, Chapter 18 and Appendix J, with exceptions noted in this report. Site preparation should be observed and documented by Columbia West.

6.1.2 Demolition

Where required, demolition includes removal of structural features that may be at the site. Abandoned foundations and utilities (if present) will need to be removed and the resulting excavations backfilled. Utility lines should be completely removed or, with prior approval, grouted full if left in place. Excavations left from demolition and removal of existing structures should be backfilled with compacted structural fill in accordance with Section 6.6.1 (Structural Fill).

6.1.3 Stripping and Grubbing

Where encountered, existing root zones should be stripped and removed from all areas to receive new structural improvements. Based on our explorations, the average depth of stripping will be approximately 4 inches for most of the site. Increased stripping depths may be anticipated in areas with thicker vegetation and shrubs. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported offsite for disposal or used in landscaped areas.

6.1.4 Topsoil Zone

An approximately 6-inch-thick topsoil zone was observed throughout the site. Topsoil zones typically have lower densities and contain slightly higher organic contents. The topsoil zone generally exhibits low strength and does not provide adequate support for structural improvements. We recommend improving the topsoil zone during site preparation where it will not be removed by site cuts.

In all structural fill, pavement, and improvement areas, the soil in topsoil zones should be removed and replaced with structural fill or scarified and compacted in place. Scarification and compaction of the subgrade may be the most economical option for subgrade improvement; however, it will likely only be possible during extended dry periods and following moisture conditioning of the soil. As discussed further on in this report, cement amendment is an option for conditioning the soil for use as structural fill during periods of wet weather or when drying the soil is not an option.

6.1.5 Test Pit Locations

The test pit excavations were backfilled using relatively minimal compactive effort of the excavator bucket. Soft spots can be expected at these locations. We recommend this relatively uncompacted soil be removed from the test pits to a depth of 3 feet below finished subgrade. If a test pit is located within 10 feet of a footing, we recommend full-depth removal of the uncompacted soil. The resulting excavation should be brought back to grade with structural fill.

6.1.6 Subgrade Evaluation

Upon completion of stripping and prior to the placement of structural fill or pavement improvements, exposed subgrade soil should be evaluated by proof rolling with a fully loaded dump truck or similar heavy, rubber-tired construction equipment. When the subgrade is too wet for proof rolling or access with a truck is not possible, a foundation probe may be used to identify areas of soft, loose, or unsuitable soil. Columbia West should perform subgrade evaluation. If soft or yielding subgrade areas are identified during evaluation, we recommend the subgrade be over excavated and backfilled with compacted imported granular fill.

6.2 CONSTRUCTION TRAFFIC AND STAGING

The near-surface fine-grained soil may be disturbed during construction. If not carefully executed, site preparation, utility trench work, and roadway excavation can create extensive soft areas and significant repair costs can result. Earthwork planning, regardless of the time of year, should include considerations for minimizing subgrade disturbance.

If construction occurs during or extends into the wet season or if the moisture content of the surficial soil is more than a couple percentage points above optimum, site stripping and cutting may need to be accomplished using track-mounted equipment. Likewise, the use of granular haul roads and staging areas will be necessary for support of construction traffic during the rainy season or when the moisture content of the surficial soil is more than a few percentage points above optimum.

The aggregate base thicknesses for pavement areas are intended to support post-construction design traffic loads and are not designed to support construction traffic. Moreover, if construction is planned for periods when the subgrade soil is wet, staging and haul roads with increased

thicknesses of aggregate base will be required. The amount of staging and haul road areas, as well as the required thickness of granular material, will vary with the contractor's sequencing of a project and type/frequency of construction equipment and should, therefore, be the responsibility of the contractor. Based on our experience, between 12 and 18 inches of imported granular material are generally required in staging areas and between 18 and 24 inches in haul road areas. The contractor should also be responsible for selecting the type of material for construction of haul roads and staging areas. A geotextile fabric can be placed as a barrier between the subgrade and imported granular material in areas of repeated construction traffic to help prevent silt migration into the aggregate base. The imported granular material, stabilization material, and geotextile fabric should meet the specifications in Section 6.6 (Materials).

As an alternative to thickened crushed rock sections, haul roads and staging areas may be constructed using cement-amended subgrade overlain by a crushed rock wearing surface. If this approach is used, the thickness of granular material in staging areas and along haul roads can typically be reduced to between 6 and 9 inches. This recommendation is based on an assumed minimum unconfined compressive strength of 100 psi for subgrade amended to a depth of 12 to 16 inches. The actual thickness of the amended material and imported granular material will depend on the contractor's means and methods and should be the contractor's responsibility. Cement amendment is discussed in Section 6.6 (Materials). Due to the plasticity of the near-surface soil, at least two passes with a tiller should be assumed to adequately mix the cement with the on-site soil.

Project stakeholders should understand that wet weather construction is risky and costly. Proper construction methods and techniques are critical to overall project integrity and should be observed and documented by Columbia West.

6.3 SLOPE CONSTRUCTION AND DRAINAGE

Fill slopes should consist of structural fill material as discussed in Section 6.6.1 (Structural Fill). Fill placed on existing grades steeper than 5H:1V should be horizontally benched at least 10 feet into the slope. Fill slopes with grades of 3H:1V and steeper should also be overbuilt by at least 3 feet and cut back to finish grade. A typical fill slope cross section is shown on Figure 6. Drainage implementations, including subdrains or perforated drainpipe 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. The 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. Fill slopes should be overbuilt, compacted, and trimmed at least 2 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.

6.4 EXCAVATION

Conventional earthmoving equipment in proper working condition should generally be capable of performing the anticipated site excavations. Based on our explorations, the subsurface profile generally consists of silty gravel underlain by dense granular soil. Perched groundwater seepage was observed in test pit TP-2 at a depth of 5 feet BGS.

Bedrock was not encountered in the test pits completed for this study. However, partially cemented sandstone was encountered in TP-4 at a depth of approximately 3 feet BGS. The sandstone exhibits increased excavation resistance compared to the overlying soil and may locally increase excavation difficulty. In addition, geologic mapping indicates conglomerate deposits may be present within portions of the site. If encountered during grading, utility construction, or foundation excavations, conglomerate and cemented sandstone may require heavier excavation equipment, ripping, hydraulic rock breaking, or other specialized excavation methods. Excavation conditions are expected to vary across the site depending on the distribution and continuity of these materials.

Temporary excavation sidewalls in the near-surface fine-grained soil may temporarily stand near vertical to depths of approximately 4 feet in relatively dry and stable conditions; however, localized sloughing or instability may occur depending on actual moisture conditions encountered during construction. Open cut excavation techniques may be feasible for deeper excavations, provided side slopes are laid back to a stable inclination. Excavation slopes should be flattened if excessive sloughing, raveling, seepage, or other unstable conditions are encountered.

Localized excavation difficulty should be anticipated where weathered or competent basalt is encountered. The contractor should anticipate variable excavation conditions across the site.

Shoring may be required where open cut excavations are not feasible or where excavations are located adjacent to existing or proposed improvements. Localized dewatering measures may be necessary if groundwater seepage or perched water conditions are encountered during construction. The contractor should be responsible for selecting appropriate excavation support, dewatering methods, and construction procedures based on actual field conditions encountered during construction.

All excavations should be performed in accordance with applicable OSHA requirements and regulations of the state, county, and local jurisdiction. While this report describes anticipated excavation conditions, the contractor remains responsible for selecting excavation and dewatering methods, monitoring excavations for safety, and providing shoring (as required) to protect personnel and adjacent structural elements.

6.5 CONSTRUCTION DEWATERING

The contractor should be responsible for temporary drainage of surface water, perched water, and groundwater. Dewatering should be performed to the extent necessary to prevent standing water and/or erosion of exposed site soil. During rough and finished grading of building pad areas, the contractor should keep all footing excavations and slab subgrade soil free of standing water.

The need for dewatering will depend on the time of year and depth of excavations. If perched groundwater is encountered, pumping from a sump located in the trench may be effective in dewatering localized sections of trench. However, this method is unlikely to prove effective in dewatering long sections of trench or large excavations. In addition, the sidewalls of trench excavations will need to be flattened or shored if seepage is encountered. We note that these

recommendations are for guidance only. Dewatering of excavations is the sole responsibility of the contractor, as the contractor is in the best position to select these systems based on their means and methods.

If groundwater is present at the base of a utility excavation, we recommend placing a minimum of 12 inches of stabilization material at the base of the excavation. The actual thickness of stabilization material should be determined at the time of construction based on observed field conditions. Trench stabilization material should be placed in one lift and compacted until well-keyed. Stabilization material and geotextile fabric should meet the requirements in Section 6.6 (Materials).

6.6 MATERIALS

6.6.1 Structural Fill

6.6.1.1 General

Areas proposed for fill placement should be appropriately prepared as described in Section 6.1 (Site Preparation). Engineered fill placement should be observed by Columbia West. Compaction of engineered structural fill should be verified by proof rolling or 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.

Various materials may be acceptable for use as structural fill. Structural fill should be free of organic material or other unsuitable material and should meet the specifications provided in the following sections. Representative samples of proposed engineered structural fill should be submitted for laboratory testing and approval by Columbia West prior to placement. All structural fill should be free of organic material and have a particle size of less than 6 inches.

6.6.1.2 On-Site Soil

The on-site soil is suitable for use as structural fill if it is adequately dried or moisture conditioned to achieve recommended compaction specifications. Based on experience, we anticipate the moisture content of the on-soil will generally be above the optimum moisture content required to meet compaction requirements and drying of the soil will be necessary. Accordingly, extended dry weather will be required to adequately condition and place the soil as structural fill. It will be difficult, if not impossible, to adequately compact the on-site soil during the rainy season or during prolonged periods of rainfall.

On-site soil used as structural fill should be placed in loose lifts not exceeding 8 inches thick and compacted using standard conventional compaction equipment. The soil moisture content should be within a few percentage points of optimum conditions. The soil should be compacted to at least 92 percent of maximum dry density as determined by ASTM D1557.

The on-site soil will likely expand during excavation and transport and consolidate during compaction. Development of site-specific expansion and consolidation factors is beyond the scope of this study. We can provide site-specific factors upon request.

6.6.1.3 Imported Granular Material

Imported granular material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel and sand meeting the specifications in WSS 9-03.14(1) – Gravel Borrow. Imported granular material should be placed in loose lifts not exceeding 12 inches thick and compacted to at least 95 percent of maximum dry density as determined by ASTM D1557. During wet weather conditions or where wet subgrade conditions are present, the initial loose lift of granular fill should be approximately 18 inches thick and compacted with a smooth-drum roller operating without vibratory action.

6.6.1.4 Stabilization Material

Stabilization material should consist of durable, 4- or 6-inch-minus pit- or quarry-run rock, crushed rock, or crushed gravel and sand that is free of organic material and other deleterious material. The material should have a maximum particle size of 6 inches with less than 5 percent by dry weight passing the U.S. Standard No. 4 sieve. The material should have at least two mechanically fractured faces.

Stabilization material should be placed in loose lifts between 12 and 24 inches thick and compacted to a firm, unyielding condition. Equipment with vibratory action should not be used when compacting stabilization material over wet, fine-grained soil. If stabilization material is used to stabilize soft subgrade below pavement or construction haul roads, a subgrade geotextile should be placed as a separation barrier between the soil subgrade and stabilization material.

6.6.1.5 Trench Backfill

Trench backfill placed below, adjacent to, and up to at least 12 inches above utility lines (i.e., the pipe zone) should consist of well-graded granular material meeting the specifications in WSS 9-03.12(3) – Gravel Backfill for Pipe Zone Bedding. Pipe zone backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

Within structural areas (below pavement and building pads), trench backfill above the pipe zone should consist of WSS 9-03.19 – Bank Run Gravel for Trench Backfill or WSS 9-03.14(2) – Select Borrow with a maximum particle size of 2½ inches. Trench backfill material within 18 inches of the tops of utility pipes should be hand compacted (i.e., no heavy compaction equipment). Remaining trench backfill should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

Outside of structural areas, trench backfill placed above the pipe zone should be compacted to at least 90 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

6.6.1.6 Retaining Wall Backfill

Backfill placed behind retaining walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of free-draining granular material meeting the

specifications in WSS 9-03.12(2) – Gravel Backfill for Walls. The wall backfill should be separated from structural fill, native soil, and/or topsoil using a geotextile fabric that meets the specifications provided below for drainage geotextiles.

Wall backfill located within a horizontal distance of 3 feet from the face of a retaining wall should be compacted to 90 percent of maximum dry density as determined by ASTM D1557. Backfill placed within 3 feet of the wall should be compacted in loose lifts less than 6 inches thick using hand-operated tamping equipment (such as a jumping jack or vibratory plate compactor). Remaining wall backfill should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

6.6.1.7 Retaining Wall Leveling Pad

Crushed aggregate used as a leveling pad for retaining wall footings should consist of 1¼-inch-minus crushed aggregate meeting the specifications in WSS 9-03.9(3) – Crushed Surfacing. The leveling pad material should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

6.6.1.8 Floor Slab and Pavement Aggregate Base

Aggregate base for building floor slabs and pavement should consist of 1¼-inch-minus crushed aggregate meeting the specifications in WSS 9-03.9(3) – Crushed Surfacing. Slab aggregate base should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

6.6.1.9 Drain Rock

Drain rock should consist of angular, granular material with a maximum particle size of 2 inches. The material should be free of roots, organic material, and other unsuitable material; should have less than 2 percent fines by dry weight; and should have at least two mechanically fractured faces. Drain rock should be compacted to a well-keyed, firm condition.

6.6.2 Geotextile Fabric

6.6.2.1 Subgrade Geotextile

Subgrade geotextile should meet the specifications in WSS 9-33.2(1), Table 3, Geotextile for Separation or Soil Stabilization. The geotextile should be installed in accordance with the manufacturer's recommendations. A minimum initial aggregate base lift of 6 inches is required over geotextiles. All stabilization material should be underlain by a subgrade geotextile.

6.6.2.2 Drainage Geotextile

Drainage geotextile should meet the specifications in WSS 9-33.2(1), Table 2, Geotextile for Underground Drainage Filtration Properties. The AOS should be between U.S. Standard No. 70 and No. 100 sieves. The geotextile should be installed in accordance with the manufacturer's recommendations. A minimum initial aggregate base lift of 6 inches is required over geotextiles.

6.6.3 Pavement

6.6.3.1 AC

AC on City of Camas roadways should be in conformance with City of Camas requirements.

AC on private roadways should consist of HMA Class ½" adhering to the specifications in WSS 9-03.8(6) – HMA Proportions of Materials. The asphalt binder should consist of PG 58-22 meeting the specifications in WSS 9-02.1(4) – Performance Graded (PG) Asphalt Binder. Asphalt should be compacted to 91 percent of the theoretical maximum density as determined by ASTM D2041. Minimum and maximum AC lift thicknesses should be 2 inches and 3 inches, respectively. Nuclear gauge density testing should be conducted to verify adherence to recommended specifications. Testing frequency should be in accordance with WSS and Clark County specifications.

6.6.3.2 Cold Weather Paving Considerations

In general, AC paving is not recommended during cold weather (temperatures less than 40 degrees Fahrenheit). Compacting under these conditions can result in low compaction and premature pavement distress.

Each AC mix design has a recommended compaction temperature range that is specific for the particular AC binder used. In colder temperatures, it is more difficult to maintain the temperature of the AC mix as it can lose heat while stored in the delivery truck, as it is placed, and in the time between placement and compaction. In Washington, the AC surface temperature during paving should be at least 40 degrees Fahrenheit for lift thickness greater than 2.5 inches and at least 50 degrees Fahrenheit for lift thickness between 2 and 2.5 inches.

If AC paving must take place during cold weather construction as defined above, the contractor and design team should discuss options for minimizing risk of pavement serviceability.

6.6.4 Soil Amendment with Cement

The on-site soil can be amended with portland cement to obtain suitable properties for use as wet weather structural fill or subbase for pavement. The effectiveness of soil amendment is highly dependent on proper mixing techniques, soil moisture conditioning, and the quantity of cement. The quantity of cement applied during amendment should be based on an assumed dry unit weight of 100 pcf for the on-site soil.

6.6.4.1 Subbase Stabilization

Specific recommendations for soil amendment should be based on exposed site conditions at the time of construction. For preliminary design purposes, we recommend cement-amended subgrade for building pads and pavement subbase (below the aggregate base layer) achieve a target strength of 100 psi. The quantity of cement required to achieve the target strength will vary with moisture content and soil type. Laboratory testing of cement-amended soil should be used to confirm design expectations.

Based on our experience, the near-surface soil will require approximately 6 to 7 percent cement by weight to achieve the target strength of 100 psi. This cement percentage assumes the soil moisture content does not exceed 25 percent at the time of amendment. If the soil moisture

content is in the range of 25 to 35 percent, 7 to 8 percent cement by weight may be required to achieve the target strength. The amount of cement added to the soil at the time of construction should be based on observed field conditions and subgrade performance. During extended periods of dry weather, water may need to be applied during the amendment and tilling process to achieve the optimum moisture content required for compaction.

Cement amendment equipment should have balloon tires to minimize softening, rutting, and disturbance of the fine-grained site soil. A sheepsfoot or segmented pad roller with a minimum static weight of 40,000 pounds should be used for initial compaction. Rollers with vibratory action should not be used to compact fine-grained, cement-amended soil. Final compaction should be conducted with a smooth-drum roller with a minimum applied linear force of 700 pounds per inch. The amended soil should be compacted to at least 95 percent of maximum dry density as determined by ASTM D558.

Following cement amendment, a minimum curing time of four days is required prior to exposure to construction traffic. Construction traffic should not be allowed on unprotected, cement-amended subgrade. To protect cement-amended areas from damage, the finished surface should be covered with 4 to 6 inches of imported granular material. The protective layer of crushed rock often becomes contaminated with soil during construction, particularly in staging and haul road areas. Contaminated aggregate (where present) should be removed and replaced with clean crushed aggregate prior to construction of pavement or other permanent site improvements supported by aggregate base.

Cement amendment should not be attempted during moderate to heavy precipitation or when the ambient air temperature is below 40 degrees Fahrenheit. Cement should not be placed in areas of standing water or where saturated subgrade conditions exist.

6.6.4.2 Cement-Amended Structural Fill

If adequate compaction is not achievable with the on-site soil due to moisture or weather conditions, the soil may be cement amended and placed as general structural fill. Prior to placement of cement-amended fill, the subgrade soil should be prepared as described in Section 6.1 (Site Preparation). Where multiple lifts of cement-amended fill are necessary to meet finished grade, consecutive lifts may be placed immediately following amendment and compaction of the underlying lift. However, where the final lift of cement-amended fill will serve as building pad or pavement subbase material, the four-day cure period as discussed above is recommended.

6.6.4.3 Testing and Construction Observation

Cement amendment of the on-site soil should be observed and tested by Columbia West to document conformance with design recommendations. Cement spread rate should be verified by measuring the spread area relative to the weight of cement used or with a pan sample test conducted at one random location per lift per 20,000 square feet of cement-amended fill. Amendment depth should be verified through excavation of a small test pit and measurement at one random location per lift of cement-amended fill. Adequate compaction and moisture content should be verified by conducting nuclear gauge density testing at a frequency of approximately one test per 5,000 square feet of cement-amended fill in accordance with ASTM D6938. When

amending pavement subgrade, at least one representative sample should be collected per day of cement amendment, cured for seven days, and tested for unconfined compressive strength in accordance with ASTM D1633. The tested samples should have a minimum seven-day, unconfined compressive strength of 100 psi.

6.6.4.4 Drainage Considerations

Cement-amended soil will not drain well and will not be suitable for planting areas. The material may also be difficult to excavate with light-duty equipment. Proposed landscape areas should not be cement amended, unless accommodations are made for drainage and planting. Cement amendment in building pad areas should consider the potential for trapped water below the floor slab. Columbia West should be consulted to provide appropriate recommendations if cement amendment is proposed in building pad areas. Cement amendment should not be used if runoff during construction cannot be directed away from adjacent wetlands. Cement amendment runoff should be collected, monitored, and treated (if necessary) in accordance with applicable regulations prior to being discharged.

6.7 EROSION CONTROL

Soil at this site is susceptible to erosion by wind and water; therefore, erosion control measures should be carefully planned and installed before construction begins. Surface water runoff should be collected and directed away from sloped areas to prevent water from running down the slope face. Measures that can be employed to reduce erosion include the use of silt fences, hay bales, buffer zones of natural growth, sedimentation ponds, and granular haul roads. All erosion control methods should be in accordance with local jurisdiction standards.

7.0 OBSERVATION OF CONSTRUCTION

Satisfactory pavement, earthwork, and foundation performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Columbia West should be retained to observe subgrade preparation, fill placement, foundation excavations, drainage system installation, and pavement placement and to review laboratory compaction and field moisture-density information.

Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated.

8.0 LIMITATIONS

We have prepared this report for use by the addressee and members of the design and construction team for the proposed project. This report is subject to the limitations expressed in Appendix B.

♦ ♦ ♦

We appreciate the opportunity to be of service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,

Michael C. King, PE
Senior Project Engineer

Daniel E. Lehto, PE, GE
Principal Engineer

REFERENCES

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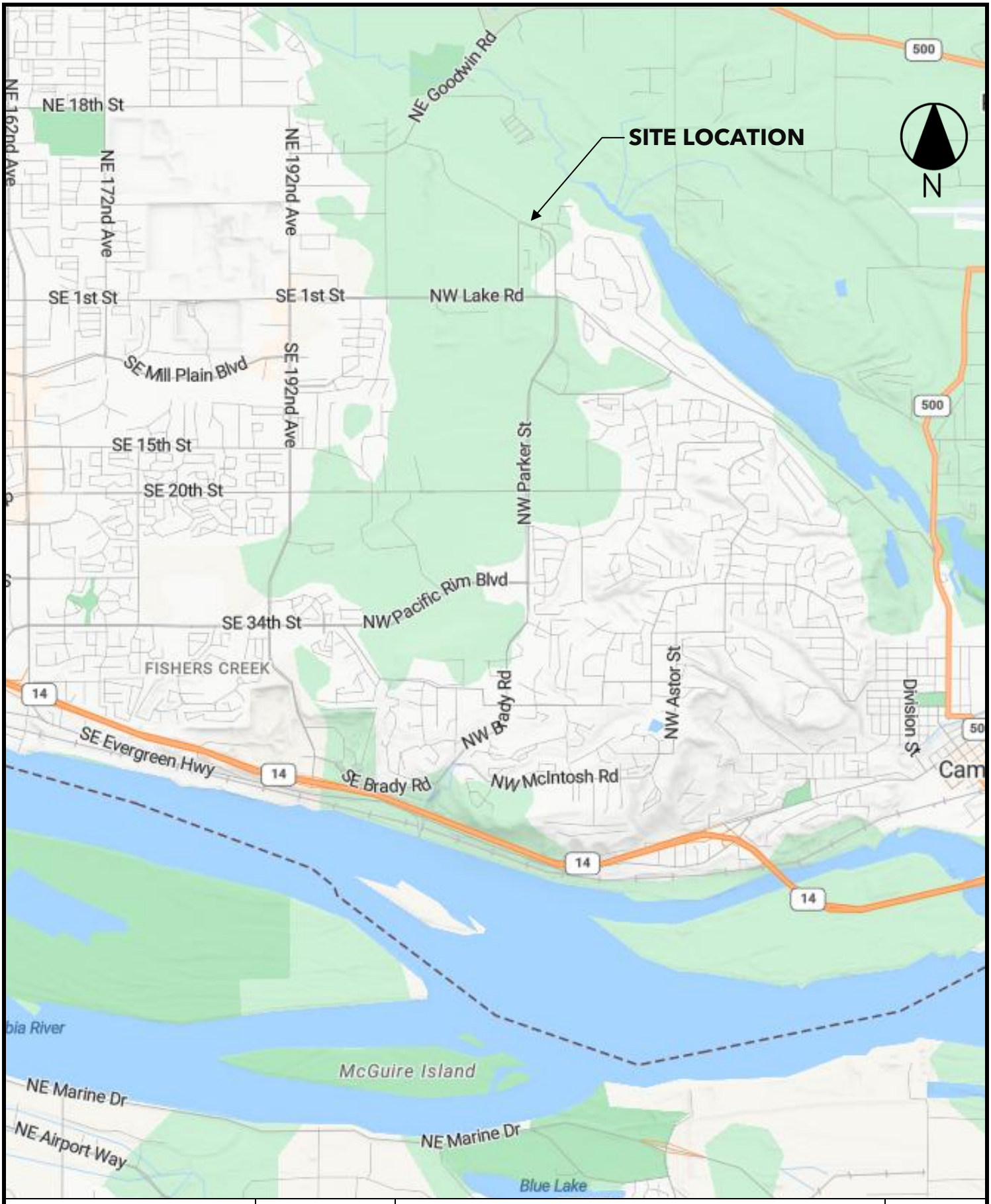
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FIGURES



Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

PROJECT NO.: MAS1A-1-01-1

JUNE 2026

VICINITY MAP
PARKLANDS II SHORT PLAT
CAMAS, WASHINGTON

FIGURE 1



LEGEND

- SITE BOUNDARY
- TEST PIT

N

0 75 150 300

SCALE IN FEET

NOTES:
1. AERIAL PHOTO SOURCED FROM GOOGLE EARTH.
2. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
3. REFER TO REPORT TEXT FOR EXPLORATION DESCRIPTIONS.

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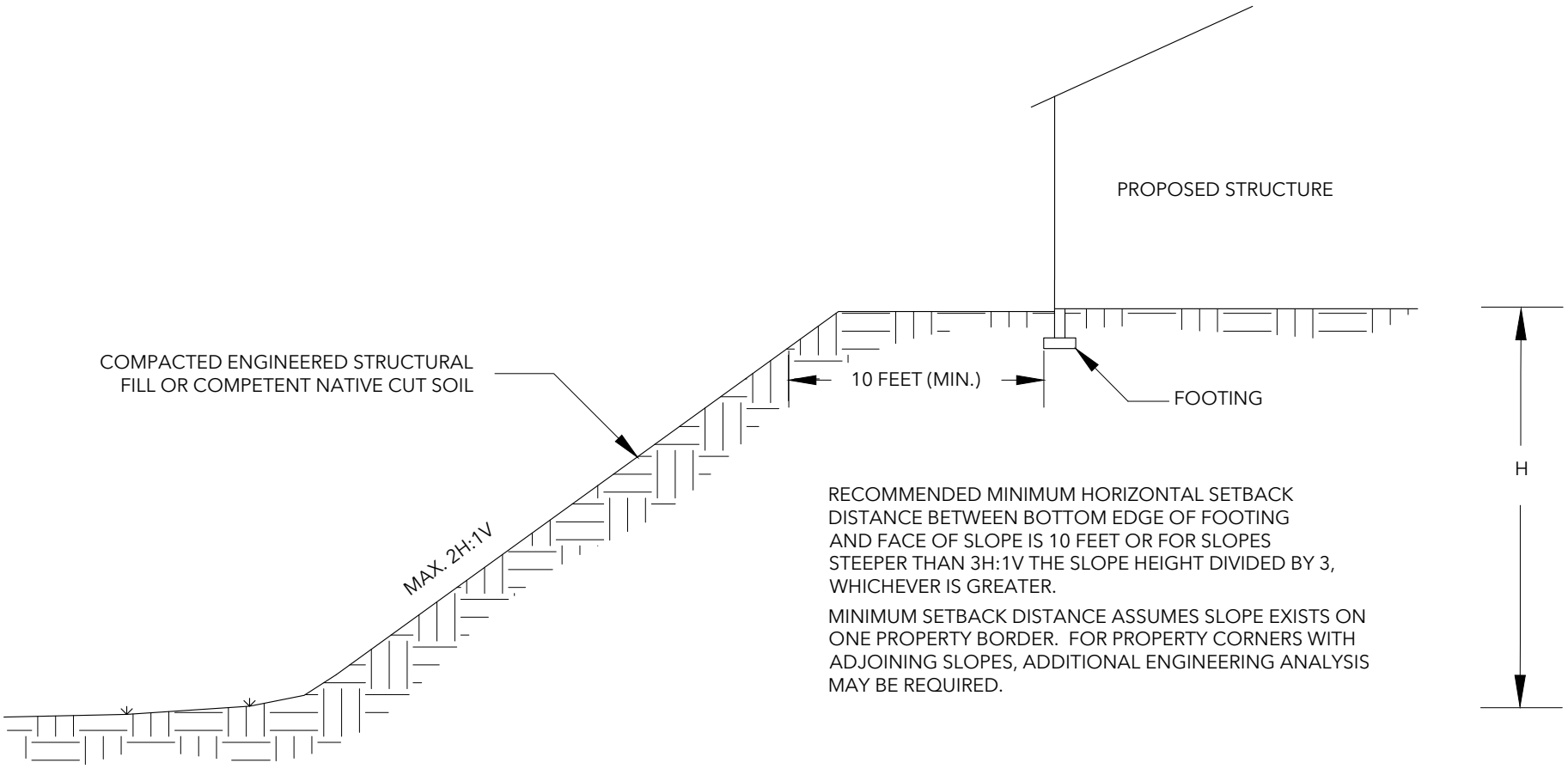
PARKLANDS II SHORT PLAT
CAMAS, WASHINGTON

SITE PLAN

PROJECT NO.:
MAS1A-1-01-1

JUNE 2026

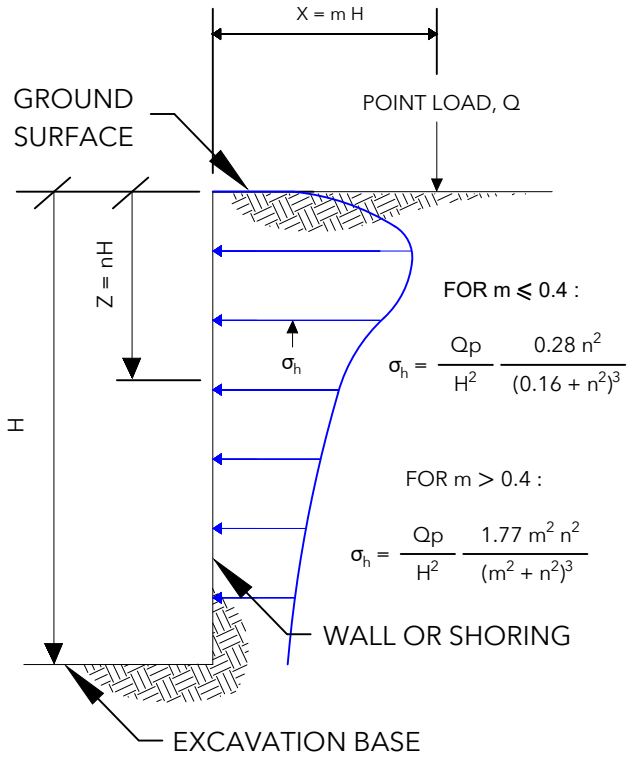
FIGURE
2



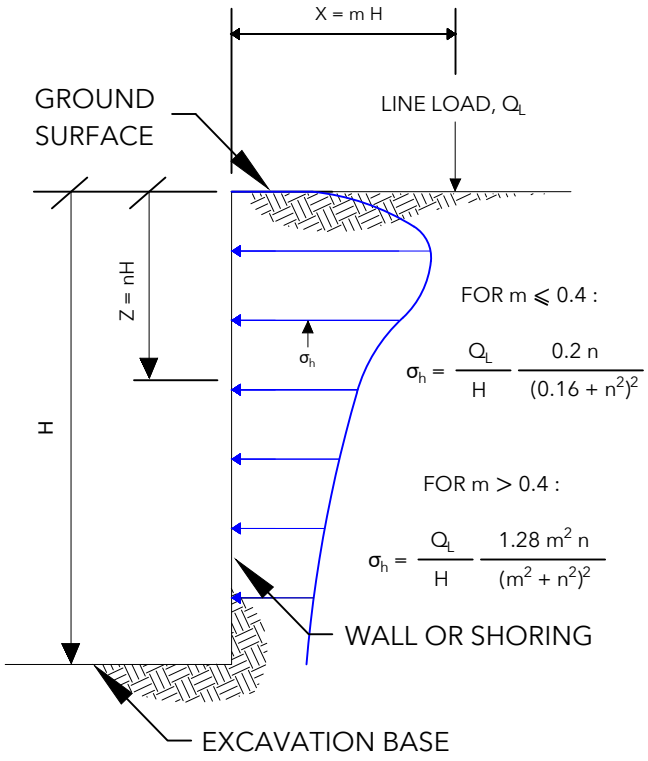
RECOMMENDED MINIMUM HORIZONTAL SETBACK DISTANCE BETWEEN BOTTOM EDGE OF FOOTING AND FACE OF SLOPE IS 10 FEET OR FOR SLOPES STEEPER THAN 3H:1V THE SLOPE HEIGHT DIVIDED BY 3, WHICHEVER IS GREATER.

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

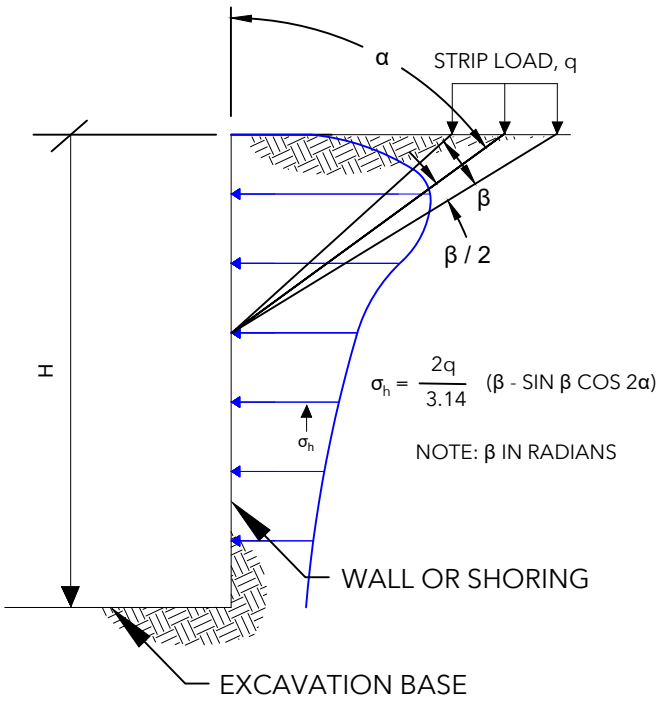
VERTICAL POINT LOAD



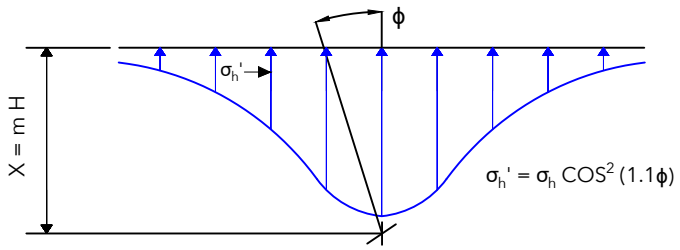
LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL

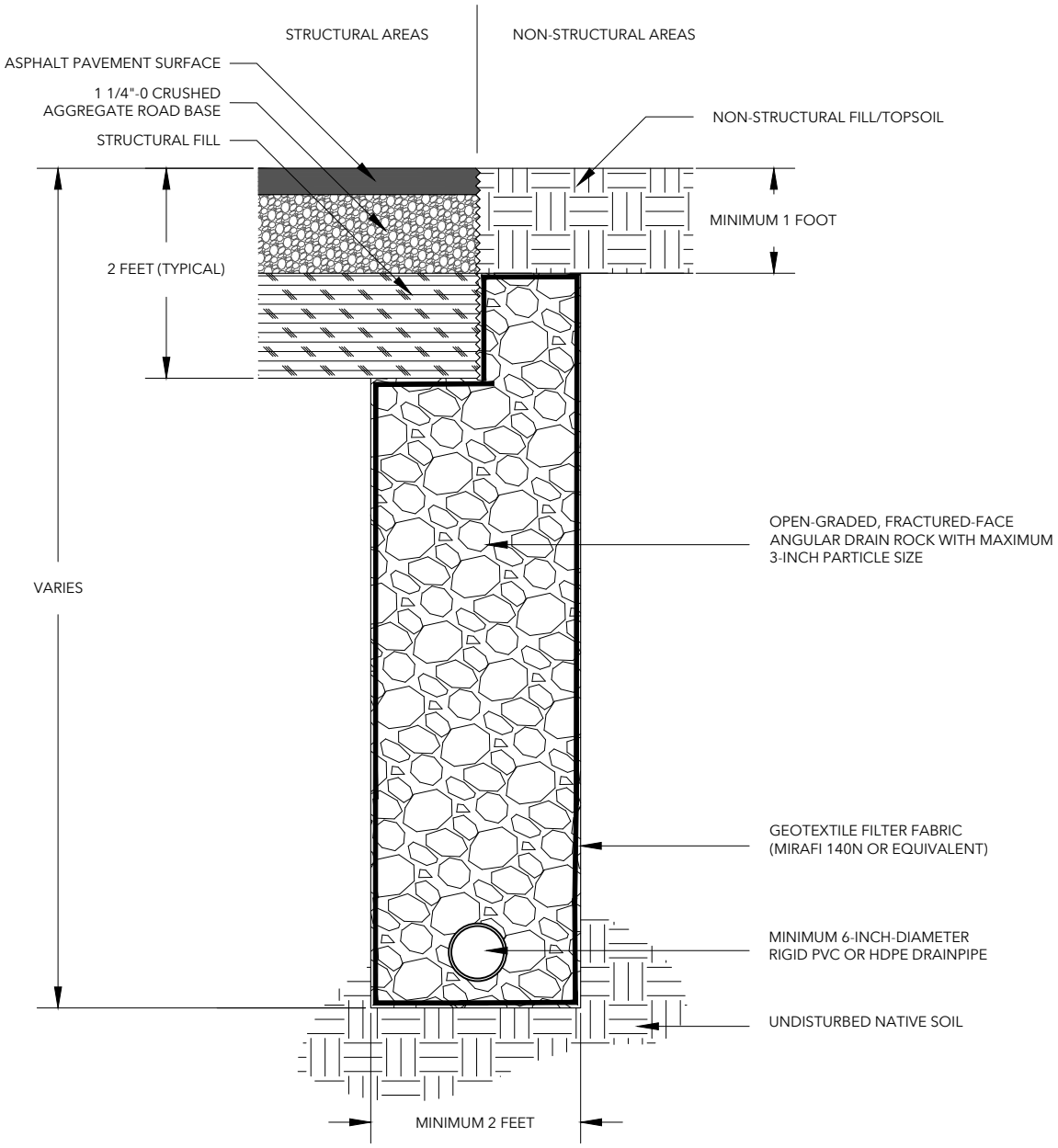


VERTICAL POINT LOAD HORIZONTAL PRESSURE DISTRIBUTION



NOTES:

1. FIGURE SHOULD BE USED JOINTLY WITH RECOMMENDATIONS PRESENTED IN THE REPORT TEXT.
2. LATERAL EARTH PRESSURES ASSUME RIGID WALLS WITH BACKFILL MATERIALS HAVING A POISSON'S RATIO OF 0.5.
3. TOTAL LATERAL EARTH PRESSURES RESULTING FROM COMBINED LOADS MAY BE CALCULATED USING SUPERPOSITION.
4. DRAWING IS NOT TO SCALE.



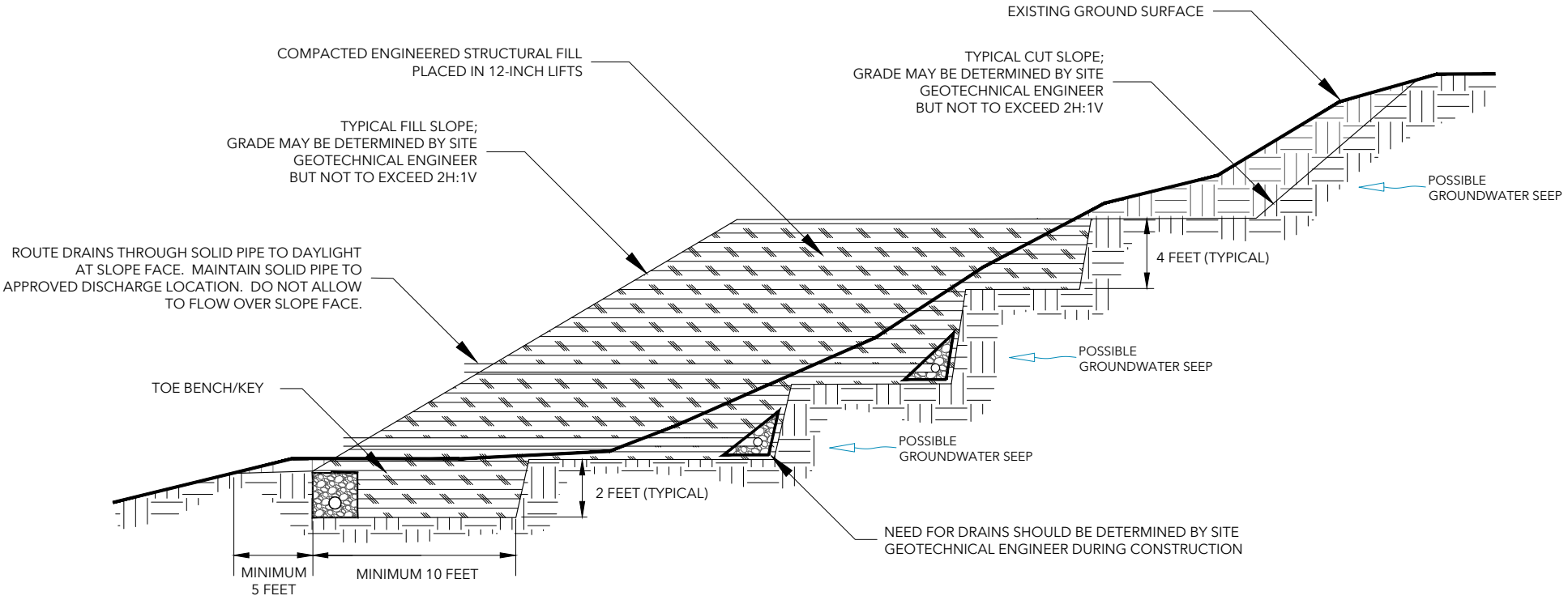
NOTE: LOCATION, INVERT ELEVATION, DEPTH OF TRENCH, AND EXTENT OF PERFORATED PIPE REQUIRED MAY BE MODIFIED BY THE SITE GEOTECHNICAL ENGINEER DURING CONSTRUCTION BASED UPON FIELD OBSERVATION AND SITE-SPECIFIC SOIL CONDITIONS.

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TYPICAL PERFORATED DRAINPIPE TRENCH DETAIL

NOTES:
1. DRAWING IS NOT TO SCALE.
2. DRAWING REPRESENTS TYPICAL PERFORATED DRAINPIPE TRENCH DETAIL AND MAY NOT BE SITE-SPECIFIC.

FIGURE 5

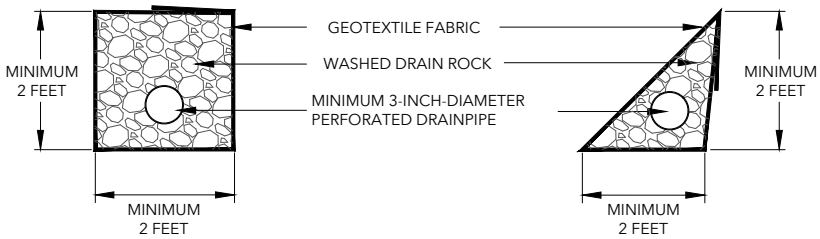


DRAIN SPECIFICATIONS

GEOTEXTILE FABRIC SHALL CONSIST OF MIRAFI 140N OR APPROVED EQUIVALENT WITH AOS BETWEEN U.S. STANDARD NO. 70 AND NO. 100 SIEVES.

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

TYPICAL DRAIN SECTION DETAIL



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TYPICAL CUT AND FILL SLOPE CROSS SECTION

NOTES:
1. DRAWING IS NOT TO SCALE.
2. DRAWING REPRESENTS TYPICAL CUT AND FILL SLOPE CROSS SECTION AND MAY NOT BE SITE-SPECIFIC.

FI

APPENDIX A

APPENDIX A
FIELD EXPLORATIONS

GENERAL

We explored subsurface conditions at the site by excavating six test pits (TP-1 through TP-6) to depths between 7 and 12 feet BGS. Excavation services were provided by L&S Contractors of Yacolt, Washington, on May 28, 2026, using a track-mounted excavator. The explorations were continuously logged by a qualified member of Columbia West's staff. The exploration logs are presented in this appendix.

The approximate exploration locations are shown on Figure 2. The exploration locations were determined in the field by pacing or measuring from existing site features. This information should be considered accurate only to the degree implied by the methods used.

SOIL SAMPLING

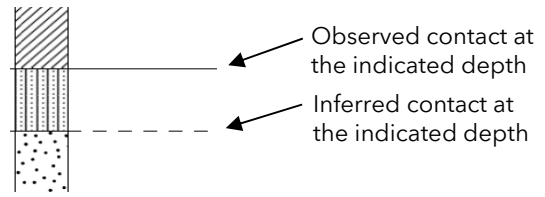
Representative disturbed samples of soil observed in the test pit explorations were collected from the test pit walls and bases using the excavator bucket. Sampling methods and intervals are shown on the exploration logs.

SOIL CLASSIFICATION

Descriptions of sampling methods and the abbreviations used on the exploration logs are presented on the "Exploration Legend" and the soil samples were classified in the field in accordance with the "Soil Classification System," which are presented in this appendix. The exploration logs indicate the depths at which the soil characteristics change, although the change could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications are shown on the exploration logs.

EXPLORATION LEGEND

SAMPLING METHOD	DESCRIPTION
SPT	Sample collected from the indicated depth in general accordance with ASTM D1586, *Standard Test Method Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils,* using an SPT sampler and 140-pound hammer
SH	Sample collected from the indicated depth in general accordance with ASTM D1587, *Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes,* using a thin-walled Shelby tube, or in general accordance with ASTM D6519, *Standard Practice for Sampling of Soil Using the Hydraulically Operated Stationary Piston Sampler,* using a thin-walled tube
D&M	Sample collected from the indicated depth in general accordance with ASTM D3550, *Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils,* using a Dames & Moore sampler and 140-pound hammer or pushed
CSS	Sample collected from the indicated depth in general accordance with ASTM D3550, *Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils,* using a 3-inch-outside diameter California split-spoon sampler and 140-pound hammer
DP	Sample collected from the indicated depth in general accordance with ASTM D6282, *Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations,* using a direct-push soil sampler
GRAB	Grab sample collected from the indicated depth
CORE	Pavement or rock core interval at the indicated depth



GEOTECHNICAL ABBREVIATIONS			
ATT	Atterberg limits	PP	Pocket penetrometer
CBR	California bearing ratio	P200	Percent passing No. 200 sieve
CON	Consolidation test	RES	Resilient modulus
DD	Dry density	SIEV	Sieve analysis
DS	Direct shear	TS	Torvane shear
HYD	Hydrometer	tsf	Tons per square foot
MC	Moisture content	UC	Unconfined compressive strength
MD	Moisture-density relationship	UU	Unconsolidated undrained triaxial test
NP	Non-plastic	VS	Vane shear
OC	Organic content	WD	Wet density

ENVIRONMENTAL ABBREVIATIONS			
CA	Sample submitted for chemical analysis	ND	Not detected
		NS	No sheen
PID	Photoionization detector headspace analysis	SS	Slight sheen
		MS	Moderate sheen
ppm	Parts per million	HS	Heavy sheen

SOIL CLASSIFICATION SYSTEM

PARTICLE-SIZE CLASSIFICATION

COMPONENT	ASTM / USCS		AASHTO	
	Size Range	Sieve Size Range	Size Range	Sieve Size Range
Boulders	Greater than 300 mm	Greater than 12 inches	--	--
Cobbles	75 mm to 300 mm	3 inches to 12 inches	Greater than 75 mm	Greater than 3 inches
Gravel	75 mm to 4.75 mm	3 inches to No. 4 sieve	75 mm to 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm to 19.0 mm	3 inches to 3/4-inch sieve	--	--
Fine	19.0 mm to 4.75 mm	3/4-inch to No. 4 sieve	--	--
Sand	4.75 mm to 0.075 mm	No. 4 to No. 200 sieve	2.00 mm to 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm to 2.00 mm	No. 4 to No. 10 sieve	2.00 mm to 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm to 0.425 mm	No. 10 to No. 40 sieve	--	--
Fine	0.425 mm to 0.075 mm	No. 40 to No. 200 sieve	0.425 mm to 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	Less than 0.075 mm	Passing No. 200 sieve	Less than 0.075 mm	Passing No. 200 sieve

CONSISTENCY FOR FINE-GRAINED SOIL

CONSISTENCY	SPT N-VALUE (blows per foot)	D&M N-VALUE (blows per foot)	POCKET PENETROMETER (unconfined compressive strength [tsf])
Very soft	0 to 2	0 to 3	Less than 0.25
Soft	2 to 4	3 to 6	0.25 to 0.5
Medium stiff	4 to 8	6 to 12	0.5 to 1.0
Stiff	8 to 15	12 to 25	1.0 to 2.0
Very stiff	15 to 30	25 to 65	2.0 to 4.0
Hard	Greater than 30	Greater than 30	Greater than 4.0

RELATIVE DENSITY FOR COARSE-GRAINED SOIL

RELATIVE DENSITY	SPT N-VALUE (blows per foot)	D&M N-VALUE (blows per foot)
Very loose	0 to 4	0 to 11
Loose	4 to 10	11 to 26
Medium dense	10 to 30	26 to 74
Dense	30 to 50	74 to 120
Very dense	Greater than 50	Greater than 120

MOISTURE DESIGNATIONS

TERM	FIELD IDENTIFICATION
Dry	Very low moisture, dry to touch
Moist	Damp, color appears darkened, without visible moisture, cohesive soil will clump, sand will bulk
Wet	Visible free water, usually saturated

ADDITIONAL CONSTITUENTS

PERCENT	SILT AND CLAY IN		PERCENT	SAND AND GRAVEL IN		PERCENT	SECONDARY MATERIAL
	Fine-Grained Soil	Coarse-Grained Soil		Fine-Grained Soil	Coarse-Grained Soil		Organics and Man-Made Debris
< 5	trace	trace	< 5	trace	trace	< 4	trace
5 – 12	minor	with	5 – 15	minor	minor	4 – 12	some
> 12	some	silty/clayey	15 – 30	with	with		
			> 30	sandy/gravelly	with		

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Columbia West Engineering, Inc

TEST PIT NUMBER: TP-1

PROJECT NAME Parklands II Short Plat
CLIENT MAS1A LLC
PROJECT NO. MAS1A-1-01-1
PROJECT CITY, STATE Camas, Washington
CONTRACTOR L&S Contractors
DATE COMPLETED 05/28/2026
EQUIPMENT CAT 307E2, 3-foot toothed bucket
TIME STARTED 8:02 AM
LOGGED BY N. Casas
TIME COMPLETED 8:24 AM

DEPTH (ft)	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE ID	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
			Dense, brown silty GRAVEL with cobbles, moist, gravel is fine to coarse and subangular, cobbles are approximately 5-10% (6 inches of topsoil, 4-inch-thick root zone). 0.5					
			Dense, brown silty GRAVEL with cobbles, moist, gravel is fine to coarse and subangular, cobbles are approximately 5-10% - **FILL**.	Grab	TP1.1			
			3.5					
			Loose to medium dense, dark brown-black silty GRAVEL, trace organics (roots), wet, gravel is fine to coarse and subangular. 4.5	Grab	TP1.2			
5	GM		Medium dense to dense, brown silty GRAVEL with sand, moist, gravel is fine to coarse and subrounded, sand is fine to coarse. Without organics at 5 feet. 8.0					Slight organic odor; likely remnant organics from the previously stripped topsoil layer.
			Exploration completed at 8 feet.					
10								

GROUNDWATER: Not observed

CAVING: Minor at 5 feet

BoreDM Template: Test Pit - Geotech | Date Printed: June 08, 2026

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

TEST PIT NUMBER: TP-2

PROJECT NAME Parklands II Short Plat
CLIENT MAS1A LLC
PROJECT NO. MAS1A-1-01-1
PROJECT CITY, STATE Camas, Washington
CONTRACTOR L&S Contractors
DATE COMPLETED 05/28/2026
EQUIPMENT CAT 307E2, 3-foot toothed bucket
TIME STARTED 8:28 AM
LOGGED BY N. Casas
TIME COMPLETED 8:47 AM

DEPTH (ft)	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE ID	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
			Medium dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subangular (6 inches of topsoil, 4-inch-thick root zone). 0.5					
			Medium dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subangular - **FILL**. 4.0	Grab	TP2.1			
5	GM		Loose to medium dense, dark brown-black silty GRAVEL, wet, gravel is fine to coarse and subangular. 5.0	Grab	TP2.2			Slight organic odor; likely remnant organics from the previously stripped topsoil layer.
			Dense, brown silty GRAVEL, moist, gravel is fine to coarse and subrounded. 8.0					
			Exploration completed at 8 feet.					
10								

GROUNDWATER: Slow to moderate seepage at 5 feet (perched)

CAVING: Not observed

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Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

TEST PIT NUMBER: TP-3

PROJECT NAME Parklands II Short Plat
CLIENT MAS1A LLC
PROJECT NO. MAS1A-1-01-1
PROJECT CITY, STATE Camas, Washington
CONTRACTOR L&S Contractors
DATE COMPLETED 05/28/2026
EQUIPMENT CAT 307E2, 3-foot toothed bucket
TIME STARTED 8:49 AM
LOGGED BY N. Casas
TIME COMPLETED 9:05 AM

DEPTH (ft)	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE ID	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
			Dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subangular (6 inches of topsoil, 4-inch-thick root zone). 0.5					
			Dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subangular - **FILL**. With cobbles, cobbles are approximately 5-10% at 1 foot. Without cobbles and organics at 3 feet. 4.0					
5	ML		Medium stiff, brown SILT with sand, gravel, and cobbles, moist, sand is fine to coarse, gravel is fine to coarse and subrounded. 9.0	Grab	TP3.1			
			Exploration completed at 9 feet.					
10								

GROUNDWATER: Not observed
CAVING: Not observed

BoreDM Template: Test Pit - Geotech | Date Printed: June 08, 2026

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

TEST PIT NUMBER: TP-4

PROJECT NAME Parklands II Short Plat
CLIENT MAS1A LLC
PROJECT NO. MAS1A-1-01-1
PROJECT CITY, STATE Camas, Washington
CONTRACTOR L&S Contractors
DATE COMPLETED 05/28/2026
EQUIPMENT CAT 307E2, 3-foot toothed bucket
TIME STARTED 9:06 AM
LOGGED BY N. Casas
TIME COMPLETED 9:38 AM

DEPTH (ft)	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE ID	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
			Dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subrounded (6 inches of topsoil, 4-inch-thick root zone). 0.5					
			Dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subrounded - **FILL**.					
			With cobbles, without organics, cobbles are approximately 5-10% at 2 feet.	Grab	TP4.1			
			Without cobbles at 3 feet. 3.0					
			Very dense, light brown silty SAND with gravel, moist, sand is fine to coarse, gravel is fine to coarse and subrounded, strong cementation.	Grab	TP4.2			
5	SM		7.0					
			Exploration completed at 7 feet.					
10								

GROUNDWATER: Not observed

CAVING: Not observed

BoreDM Template: Test Pit - Geotech | Date Printed: June 08, 2026

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

TEST PIT NUMBER: TP-5

PROJECT NAME Parklands II Short Plat
CLIENT MAS1A LLC
PROJECT NO. MAS1A-1-01-1
PROJECT CITY, STATE Camas, Washington
CONTRACTOR L&S Contractors
DATE COMPLETED 05/28/2026
EQUIPMENT CAT 307E2, 3-foot toothed bucket
TIME STARTED 9:42 AM
LOGGED BY N. Casas
TIME COMPLETED 10:09 AM

DEPTH (ft)	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE ID	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
			Dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subrounded (6 inches of topsoil, 4-inch-thick root zone). 0.5					
			Dense, brown silty GRAVEL, trace organics, moist, gravel is fine to coarse and subrounded - **FILL**. With cobbles, without organics, cobbles are approximately 5-10% at 2 feet. 5.0					
5	GM		Loose to medium dense, dark brown silty GRAVEL, trace organics (roots), moist, gravel is fine to coarse and subangular. With cobbles, cobbles are approximately 10-20% at 6 feet. Without cobbles at 8 feet. 10.0	Grab	TP5.1			Slight organic odor; likely remnant organics from the previously stripped topsoil layer.
10			Dense, brown silty GRAVEL, moist, gravel is fine to coarse and subrounded. 11.0	Grab	TP5.2			
			Exploration completed at 11 feet.					

GROUNDWATER: Not observed

CAVING: Not observed

BoreDM Template: Test Pit - Geotech | Date Printed: June 08, 2026

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

TEST PIT NUMBER: TP-6

PROJECT NAME Parklands II Short Plat
CLIENT MAS1A LLC
PROJECT NO. MAS1A-1-01-1
PROJECT CITY, STATE Camas, Washington
CONTRACTOR L&S Contractors
DATE COMPLETED 05/28/2026
EQUIPMENT CAT 307E2, 3-foot toothed bucket
TIME STARTED 10:11 AM
LOGGED BY N. Casas
TIME COMPLETED 10:40 AM

DEPTH (ft)	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE ID	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
			Dense, brown silty GRAVEL with cobbles, trace organics, moist, gravel is fine to coarse and subrounded, cobbles are approximately 5-10% (6 inches of topsoil, 4-inch-thick root zone). 0.5					
			Dense, brown silty GRAVEL with cobbles, trace organics, moist, gravel is fine to coarse and subrounded, cobbles are approximately 5-10% - **FILL**. 4.0	Grab	TP6.1			
5	GM		Loose to medium dense, dark brown-black silty GRAVEL with cobbles, trace organics (roots), moist, gravel is fine to coarse and subangular, cobbles are approximately 5-10%.	Grab	TP6.2			Slight organic odor; likely remnant organics from the previously stripped topsoil layer.
			Without cobbles and organics at 8 feet. 9.0					
10			Dense, brown silty GRAVEL, moist, gravel is fine to coarse and subrounded. 12.0					
			Exploration completed at 12 feet.					

GROUNDWATER: Not observed

CAVING: Not observed

BoreDM Template: Test Pit - Geotech | Date Printed: June 08, 2026

APPENDIX B

APPENDIX B
DOCUMENT LIMITATIONS AND IMPORTANT INFORMATION

Document Purpose, Use, and Standard of Care

This document has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and consulting and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This document 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 document 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 document, it may not be valid. Columbia West cannot accept responsibility for use of this document 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.

Document Conclusions and Preliminary Nature

This document should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soil based on conditions observed during site exploration. The exploration and associated laboratory testing of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the site. 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 exploration logs. This document 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 document is based on observations 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. Document conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the site. Groundwater conditions, if presented in this document, reflect observed conditions at the time of exploration. These conditions may change annually, seasonally, or as a result of adjacent development.

Additional Investigation and Construction Observation

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

Therefore, this document 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 soil is exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this document or future performance of structures 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 document will be retained for 30 days. Retention of such samples beyond 30 days will occur only at client's request and in return for payment of incurred storage charges. All contaminated or environmentally impacted material or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Document Contents

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Geotechnical documents, 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 document is usually less than that necessary for contractor's needs. Contractors should be advised of these document limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this document, but should rely on 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 purpose of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

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Consultant Responsibility

Geotechnical engineering and consulting is much less exact than other scientific or engineering disciplines and relies heavily on experience, judgment, interpretation, and opinion often based on media (soil) that is variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical consultant. To reduce the potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical documents 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.

FINAL STORMWATER DESIGN REPORT (TIR)
Parklands at Camas Meadows Subdivision
SUB15-03

Parcels #175948-000 986031-650
and Parklands Archery Business Park
and Camas Meadows Drive

(TIR also includes Conveyance Capacity Quantity Only for
and Village at Camas Meadows
and Larkspur Drive South Subarea)

IN THE CITY OF CAMAS



12-29-2016

CERTIFICATION OF FEASIBILITY-
The stormwater plan designed for the Parklands Residential Subdivision and Parklands Business Park is FEASIBLE and has been designed in accordance with Camas Municipal Code (CMC) 14.02 and Camas Stormwater Design Standards Manual (CSDSM) and has the ability to meet or exceed the applicable code requirements.

PREPARED BY
Kessi Consulting – James Kessi P.E.
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Vancouver, WA 98665
james.kessi@gmail.com
360-991-9300

December 29, 2016

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A-2 FIRM Map
A-3 Basin Maps
1) **Fig. 1A Historic Basin Map**
2) **Fig 1B Historic Basin Map – add projects**
3) **Fig 3 Post Subbasin Map**

A-4 Selected Soils Data and Soils Map
A-5 Isopluvial Maps

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B-2 MR #8 Wetlands Protection Evaluation
B-2a Support files for Hydroperiod Evaluation
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B-3 MR #7 Flow Control

Appendix C Runoff Treatment

C-1 Water Quality Flow Rates
C-2 Perk Filter Sizing Summary
C-3 Phosphorus Reduction

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HCAD for Line A and B – 10-yr
HCAD for Line C – 10-yr
HCAD for Line E – 10-yr
HCAD for Line D, E, and F – 10-yr
HCAD for Line G
HCAD Thru Wetlands – 10-yr
HGL analysis
HCAD for Line A and B – 10-yr
HCAD for Line C – 10-yr
HCAD for Line D, E, and F – 10-yr
HCAD for Line G

D-2 Conveyance Design Comments

D-3 Dynamic Analysis Water Surface Summary for 100-yr Surcharged Condition
HCAD for Line A, B, and C – 100-yr
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E-2 Catch Basin Design Comments
E-3 Energy Dissipator Manhole Design
E-4 Flow Dispersion System – Line A and Line C

Appendix F Offsite Analysis

F-1 Offsite Analysis

Appendix G Other Reports

G-1 Geotech Report
G-2 Wetlands Evaluation - Wetlands Protection

Appendix H Maintenance
H-1 Maintenance and Operations Manual

Parklands at Camas Meadows Residential Subdivision and Parklands (aka the Archery) Business Park and Camas Meadows Drive

Section A – Project Overview

The "**Parklands at Camas Meadows Residential Subdivision and Parklands (aka the Archery) Business Park**" proposal is to subdivide two existing parcels of land into business and residential development, totaling approximately 36.4 acres grading with approximately 23.5 acres of land disturbing activity. The Property, tax parcel numbers 986031650 and 175948000, are located in a portion of the SW and SE ¼ Section 28, Township 2 North, Range 3 East of the Willamette Meridian, Clark County, Washington into up to 42 single family residences within the R-15 Zone and 6 commercial buildings. The TIR also covers the conveyance and water quality for the full width of Camas Meadows Drive along the site frontage.

This TIR also includes Conveyance Capacity Quantity Only for the Village at Camas Meadows and Larkspur Drive South basin areas. When each of these areas develops in the future, the conveyance and quantity control capacity are provided for with this TIR, but each of these projects will still need to provide water quality at the time of development.

The Property is currently undeveloped. The site topography slopes from the south, northeasterly towards the north boundary, more specifically towards the wetlands that extends southeasterly across the site (north ⅓) leaving a portion of upland area at the northeast corner that is fairly flat. The majority of the natural runoff is overland flowing from the south, northeasterly, toward the wetland areas. The site is currently covered with trees and brush.

There are several culverts located onsite, apparently to convey surface runoff across paths or trails or former field roads. These culverts will be removed. There are four specific culverts at areas that separate the three onsite wetland areas. These culverts will be retained.

Construction of the "**Parklands at Camas Meadows Residential Subdivision and Parklands (Archery) Business Park**" will consist of construction of private streets, sidewalks, single family residential lots, underground utilities, and stormwater mitigation facilities (quality control). Parking areas and loading docks will be constructed with the business park portion including utilities and stormwater mitigation facilities (quality control - including treatment for phosphorus).

Due to soil properties in this area, stormwater management by standard infiltration BMPs and LID BMP's are not generally applicable for this site. The geotechnical report also indicates that:

> *Weathered and competent conglomerate bedrock was encountered in all test pits at various depths… The bedrock consisted of angular to sub-rounded clasts of various sizes cemented in a matrix of sand, silt, and clay. The bedrock was very dense and*

excavator refusal was noted at various depths as indicated in Table 1 in Section 5.7, Excavation.

The design of the proposed stormwater system was influenced by the suitability of the existing site topography. Typically, this type of setting would lend itself to stormwater management within the wetland buffer(s). However, the buffers along these wetlands are heavily treed in most areas and tree preservation has been taken into consideration. There is also a requirement for phosphorous control. Presently, DOE has only certified a few treatment technologies through the TAPE program that meet criteria for phosphorous removal. The Filterra® System was originally proposed for the Preliminary TIR but has been replaced with the Perk Filter. The final water quality treatment design (including phosphorus control) is based on one of these TAPE approved/certified products - **PerkFilter™**, which provides both standard Water Quality Treatment and Phosphorus Control.

Further discussion is provided in **Section F – Runoff Treatment Analysis and Design**

Section B – Minimum Requirements

The "**Parklands Residential Subdivision and Parklands Business Park**" proposal contains only one threshold discharge area (TDA) and is subject to consideration of minimum requirements 1 – 10. However, only requirements 1-6, 9 and 10 are applicable. See Appendix B-1, B-2, and B-3.

Table B -1 - Summary of Land Disturbing Activities

The defined site area is 36.4 acres.

1. Amount of Existing Impervious surface	None
2. Amount of New Impervious surface*	16.5 ac.
3.Amount of Replaced Impervious surface	None
4. Amount of Native Vegetation converted to lawn or landscaping	12.03
5. Amount of Native Vegetation converted to pasture	None
6. Amount of Native Vegetation converted to pervious access area	None
7. Total amount of land-disturbing activity	23.46 acres

* Roofs and drives at individual lots assumed at 6,500 sq ft per lot on this project and driveways at a minimum of 1,000 sf.

This project includes a design for management of runoff from offsite areas located upslope from this project and which presently drain overland to and through this site. The defined **drainage area** is 70.2 acres

- Includes The Village at Camas Meadows, Camas Meadows Drive from Payne Road to Larkspur, and an area between Larkspur and The Village at Camas Meadows.

1. Amount of Existing Impervious surface	None
2. Amount of New Impervious surface*	23.61 ac.
3.Amount of Replaced Impervious surface	None
4. Amount of Native Vegetation converted to lawn or landscaping	20.73
5. Amount of Native Vegetation converted to pasture	None
6. Amount of Native Vegetation converted to pervious access area	None
7. Total amount of land-disturbing activity	47.34acres

* Roofs and drives at individual lots assumed at 4,500 sq ft per lot on this project

Table B-2 - TDA Minimum Requirement Summary

TDA Number	Req'd to meet runoff control (treatment) requirements listed in Min. Requirement 6	Req'd to meet flow control requirements listed in Min. Requirement 7	Req'd to meet wetlands protection requirements listed in Min. Requirement 8
TDA # 1	Yes	N/A – large water body	Yes

The effective impervious area for the street ROW portion is 11.43 acres. This includes the driveway entrance portion area for each lot.

Section C – Soils Evaluation

The "Soil Survey of Clark County, Washington" indicates the soil at this site consist of the following:

> (HcB) Hesson clay loam, 0 to 8 percent slopes, (HcD) Hesson clay loam, 8 to 20 percent slopes.

Clark County GIS indicates that the site soils are designated as Soil Group 3, Moderately Drained Soils for use with the Western Washington Hydrology Model (WWHM2012). The SCS or NRCS designation is HSG C.

> (CvA) Cove silty clay loam, 0 to 3 percent slopes

Clark County GIS indicates that the site soils are designated as Soil Group 4, Poorly Drained Soils for use with the Western Washington Hydrology Model (WWHM2012). The SCS or NRCS designation is HSG D.

> (LgB) Lauren gravelly loam, 0 to 8 percent slopes

Clark County has further segregated this soil group as a Group 1 soil (SG-1) Excessively drained soils (hydrologic soil groups A & B) for use with the Western Washington Hydrology Model (WWHM2012). The SCS or NRCS designation is HSG B. However, at this site the water table is high in some locations and this soil was modeled as SG-3.

See the soils map in Appendix A for additional information

According to the NRCS web soil survey,
Excerpt from Geotechnical Report:

The Web Soil Survey (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2013 Website) indicates the site is underlain by three soil types. Hesson clay loam soils are mapped on the majority of the site from the northwest corner to the southwest corner of the property, while Cove silty clay loam and Lauren gravelly loam soils are mapped in the north and northeastern portions of the property respectively. Soils resembling the Lauren series were not encountered during subsurface excavations.

Although actual on-site soils may vary from the broad USDA descriptions, Lauren soils are generally coarse-textured, well drained soils with rapid permeability. Cove soils are generally fine-textured, poorly drained soils with very slow permeability and high shrink-swell potential. Hesson soils are fine-textured, well drained soils with moderately slow permeability and moderate shrink-swell potential.

Subsurface infiltration testing was not performed. See report in Appendix F.

Section D – Source Control

There are not any prohibited discharges planned for this site. A SWPPP has been developed for the Final TIR that identifies and lists BMPs for Source Control and includes BMPS to prohibit sediment laden runoff from leaving the site and impacting any local or State waters. In addition, BMPs will be implemented as necessary to prevent pollutants from coming in contact with stormwater runoff.

The proposed site is being developed with activities that are pollution generating. The following BMP categories have some degree of applicability, in particular, BMPs for Landscaping and Lawn/ Vegetation Management and Maintenance of Stormwater Drainage and Treatment Systems.

Public Right of Way

All source control BMPs in the public right-of-way of Camas Meadows Drive and other ROW will be the responsibility of Camas City forces per their established maintenance procedures, or by a Business Park Owners' Association (BPOA) for the commercial portion - or a combination of each of the entities may be tasked for selected responsibilities. The stormwater facilities will be publicly owned and maintained in a manner consistent with the Stormwater Facility Maintenance Manual and BMPs for Landscaping and Lawn/Vegetation Management.

Private Right of Way

The stormwater facilities will be privately owned and maintained by the HOA in a manner consistent with the Stormwater Facility Maintenance Manual and BMPs for Landscaping and Lawn/Vegetation Management. This will be the responsibility of the Home Owners Association.

Business Park Owners' Association (BPOA) for Commercial Areas

The stormwater facilities will be privately owned and maintained by the BPOA in a manner consistent with the Stormwater Facility Maintenance Manual and BMPs for Landscaping and Lawn/Vegetation Management. This will be the responsibility of a BPOA representing the businesses within the development.

Individual Residential Subdivision Lot Owners

In addition to the subdivision storm system being designed to accommodate runoff from the entire site, individual lot owners will also be voluntarily responsible for source control BMPs related to installing and maintaining landscaping and roof downspout systems on their respective lots. This additional responsibility includes promotion of the voluntary prevention of introduction of pollutants into their system(s) and will be further implemented by the use of zero phosphorus yard products to assist in the reduction of phosphorus. Even if this is not fully voluntarily complied with by all future lot owners, the overall required total reduction in phosphorus for the entire site (including all residential lots draining to buffers rather than to streets) meets the required standards for the overall site. Application of appropriate maintenance measures will also provide additional source control beyond the minimum standards.

Additional Reference: SMMWW, Volume IV, Chapter 2 - Selection of Operational and Structural Source Control BMPs; 2.2 Pollutant Source-Specific BMPs

BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots

BMPs for Landscaping and Lawn/ Vegetation Management

BMPs for Maintenance of Stormwater Drainage and Treatment Systems

BMPs for Urban Streets

Section E – Onsite Stormwater Management BMPs

An Erosion Control Plan has been developed for implementation of BMPs to manage stormwater during grading activities and are shown on the erosion control plan.

Individual lot owners will be responsible for installing and maintaining roof downspout systems on their respective lots. Those lots with Downspout Dispersion Systems (BMP T5.10B) Volume III, Chapter 3.1.2 of the SMMWW (2012) will comply with the requirements of this reference.

Section F – Runoff Water Quality Treatment Analysis and Design including Phosphorus Removal (Requirement = 50% minimum for the Entire Site)

1) Basic stormwater treatment is required for the private streets in this project.
2) Enhanced stormwater treatment is required for the business portion of this project.
3) Phosphorous removal of 50% of the phosphorous load is also required for the total developed site. See Appendix C for WQ treatment rates required for street and business park systems.

See Section L – Approval Conditions Summary on page 17 regarding (Condition of Approval #17) for discussion related to Water Quality Treatment and Achieved Effective **Site Phosphorus Treatment Standards and Analysis** with further reference to Appendix C, C-3a and C-3b for Individual Lots adjacent to Wetland Buffer.

The runoff from surfaces requiring water quality and phosphorus treatment will be routed to specific Perk Filter ™ Systems. The systems are approved as off-line in nature and are sized to treat the off-line flow rate determined from WWHM2012 analysis.

F.1 The required phosphorus standard is removal of 50% of the total phosphorus that is leaving the entire site and discharging into the wetlands. To account for the lots that are adjacent to the buffers and are not able to be routed to the street systems for phosphorus removal, the overall net phosphorus removal from the site has been calculated by allotting a different removal value for these areas and determining an overall removal percentage.

F.2 In short, for a majority 84% or 23.9 acres of the entire site which drains to the street system and PerkFilters, a phosphorus removal of 62.4% is allotted per TAPE standards documentation.

F.3 For a small 16% or 4.5 acres portion of the site for the rear yards that are adjacent and drain to the wetland buffers, a conservative phosphorus removal of 40% is achieved through natural processes and overland flow through the vegetated buffers.

F.4 So, in summary, for the entire 28.4 acres of developed site the total phosphorus removal conservatively averages out to be 52%, which exceeds the minimum standard of 50% removal.

F.5 Phosphorus Removal of more than 50% is achieved for the overall site: The majority of the individual lots lawn yard and landscaped areas are being directed to the street and then to PerkFilters. Treatment for this co-mingled flow achieves both adequate water quality treatment for phosphorus removal with a TAPE approved system element (PerkFilters) for water quality and phosphorus removal treatment with the PerkFilters.

F.6 Thus, phosphorus removal standards for the entire site is met and Condition of Approval #17 is satisfied (the minimum removal standard is 50%). Phosphorus removal from the entire site is also demonstrated in detail in Appendix C, C-3a and C-3b.

> *Condition of Approval #17 Stormwater runoff from the proposed lots and landscaped areas of the site shall be directed into the streets and/or into a stormwater treatment system that will provide adequate phosphorus removal from the yard and landscaped areas of the site prior to release into the wetlands.*

F.7 As an additional voluntary measure to reduce the most likely phosphorus sources, all commercial pads and residential lots will be required by the HOA CC&R's to use only fertilizers that have a zero phosphorous designation. These restrictions will be recorded on

all lots within the final approved CCR's for the site. Even without these measures, the overall site will still comply with the phosphorus removal standards.

Business Park and Commercial Site

The runoff from the Business Park parking and landscape areas that drain onto parking pavement will receive treatment in **PerkFilter Systems** - which includes both Water Quality and Phosphorus Treatment. The runoff from the roof areas will be directly conveyed to the respective storm system and not treated.

Private Individual Lot Stormwater Management

- Lots adjacent to a wetland buffer or with discharge to a wetland separate from the main storm systems

  a) Roof and drive runoff will be re-introduced as sheet flow (dispersion) to the specific lot source. However, some of the lots along the north leg of NE Longbow Lane will drain 3,000 sf of front yard lawn area and driveway to the street system. For some lots, the roof runoff may be piped to a small conveyance system with discharge released as sheet flow to the wetland buffer.

  b) More specifically, some of the individual lots will disperse roof runoff onto the specific lot for runoff directly overland to the wetland buffer. Some lots may direct the roof downspout into a pipe tied directly to a conveyance to the associated wetland and be dispersed through the wetland buffer. A few lots that do not border the wetland will direct runoff to rear yard or side yard inline systems for release to the associated wetland for dispersal. For Phosphorus treatment considerations, see sections F.1 – F.6 above.

  c) Lots that do not border the wetland buffer areas will collect runoff from the pervious and impervious areas (not including roof areas) in one or more inlets on the lots or direct runoff directly to the street. This runoff will then receive phosphorous treatment at the respective PerkFilter. For Phosphorus treatment considerations, see sections F.1 – F.6 above.

Private Street Right of Way Stormwater Management

NW Pittock Place *formerly ~~10th Fairway Drive~~*

The runoff will be collected at a single low point catch basin and conveyed (Storm Line A) to a PerkFilter located at the north end of the cul-de-sac.

NW McMaster Dr. *formerly ~~Golf Drive~~*

Most of the lots along this street will receive direct runoff from the lawn areas and driveway areas and will receive treatment with the street R/W runoff. The roof areas will be connected directly to the storm system in the street R/W. There are several lots on the north side of this street that slope toward Wetland B and C. The runoff from these lots will be flow directly to the wetland buffers for these two wetlands. For Phosphorus treatment considerations, see sections F.1 – F.6 above

Provision has also been made to intercept potential overflow from existing detention facilities located directly south of the project. A rear yard inline system for the bordering lots will convey potential overflow to the proposed system (Line E) in McMaster Dr.

The outfall for this conveyance system will be the existing south culvert that crosses from Wetland B to Wetland A. The outfall from this connection point on the existing 12 inch culvert will be increased in size from 12 inches to 24 inches.

NW Longbow Ln. *formerly ~~17th Green Drive and NW Parklands Trail~~*

Each side will drain to PerkFilter Systems which will route (Storm Line G) the outflow to the existing north culvert that crosses from Wetland B to Wetland A. The outlet portion of the culvert will be increased from 12 inches to 24 inches.

Upbasin & Offsite:

a) Larkspur and a future development west of Larkspur (future) – a storm line is extended to receive direct flow in Storm Line 'C' for release to Wetland A – assumed that this (these) area(s) will be treated (future) prior to entering the system in Camas Meadows Drive.
b) Camas Meadows Drive and landscape areas – paved areas, sidewalk, and landscape areas treated in PerkFilter Systems.
c) The Village site storm system lines for conveyance are collected in storm Line 'B' and 'C' for continued conveyance to Wetland A.

To reduce the stormwater runoff quantity impact to the wetlands, this project is proposing that the final grading of lots will have the most suitable portions of the existing on-site top soils collected and stockpiled at the beginning of grading, and then later carefully placed back on the future front and rear yard areas of the lots. This design aspect will allow some rainfall and runoff water to continue to re-supply the interflow feature back to the soil profile – which is important for hydrating the wetlands. This approach also reduces direct surface runoff volumes from the site.

The management of flows above the WQ flow rates will be directed to the particular storm line system for controlled release to Wetland A. The existing site release is from Wetland B to Wetland A which will then flow overland north into Lacamas Lake. A small portion of the offsite and onsite drainage basin area flows to Wetland C which flows west to Wetland B through two existing culverts. For Phosphorus treatment considerations, see sections F.1 – F.6 above.

Initial installation cost and the expenses associated with long-term maintenance are expected to be typical of projects with similar street sections at these slopes and runoff from most of the interior lots. There are no pollution-generating pervious surfaces (PGPS) on this project.

The amount of pollution-generating impervious surfaces (PGIS) is:

Parklands = 11.43 acres.
Camas Meadows Drive = 1.32 acres
The Village = 6.00 acres
Larkspur = 0.46 acres
The total is 19.21 acres pollution-generating impervious surfaces (PGIS)

Section G – Flow Control Analysis and Design

Flow control facilities are not required for this project since the discharge is to an exempt water body – Lacamas Lake*. There are several design features proposed that will 'reduce' peak flow rate and volume.

- Replacement of existing on-site soils to replicate on-site soil characteristics.

See appendix B-2 and B-3.

* The discharge from the site is mostly overland to the north with a direct connection to the mouth of Lacamas Creek or the upper end of Lacamas Lake since Lacamas Lake is a man-made impoundment. The release point is into the water level established by the water level at the lake. This is an area within the backwater condition for Lacamas Creek as it enters the Lake and is subjected to the lake level – (especially for times of significant flow).

Flow Control System Plan

This project is exempt as discussed in Section G. See Appendix B-3.

Section H – Wetlands Protection

Camas Stormwater Design Standards Manual – Submittal Requirements

For projects with stormwater discharges to a wetland, either directly or indirectly through a conveyance system, the preliminary TIR shall describe wetland protection measures to be implemented in accordance with Minimum Requirement 8. The narrative shall describe the measures that will maintain the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses.

Historically, the area with runoff to this portion of the wetlands was larger than the present condition. Development along the west has diverted flow to an area west of the project and an area in the southeast has been developed as several subdivisions with separate stormwater facilities. The watershed area to this portion of the wetland complex has been reduced from about 94 acres to about 71 acres (almost 25% reduction). However, two existing developments just south of the SE corner of the site were 'incorrectly' designed to divert additional acreage and an increased 'allowable' release rate to this site. See App. A, A-3 Basin Maps.

See Appendix B, B-2 for the evaluation that determines wetland protection is provided.

Presently, stormwater runoff enters the three wetland segments as overland flow or as direct rainfall. The expected area for stormwater runoff is:

Source Area	Acres
Parklands Residential Subdivision and Parklands Business Park	26.17
The Village at Camas Meadows	17.31
Camas Meadows Drive	2.40
Offsite – east of The Village at Camas Meadows and west of Larkspur Dr.	14.4
Wetland A (including buffer)	7.97
Wetland B (including buffer)	2.71
Wetland C (including buffer)	0.27
Total	71.22

Source Area	Acres
Lacamas Estates Subdivision – routed through Storm Facility – and 3 lots with direct discharge	7.31
Larkspur Subdivision – routed through Storm Facility	7.50
Total	14.81*

* Areas per As-built files from City

- Therefore, model upstream contributing basin total is about 86 acres.

One of the design elements is to maintain the overland flow aspect – all lots directly bordering the wetland buffers will maintain direct overland runoff. Runoff from the remaining lots not bordering the wetland buffers of this development will be collected and routed to several discharge points outside of the wetland buffers.

Section I – Other Permits

Construction of roads and stormwater facilities may require additional permits from other agencies. These permits may contain requirements that affect the design of the stormwater system. This section lists the titles of other possible required permits, the agencies that require the permits, and the permit requirements, if known, that affect the final stormwater plan. Approved permits that are critical to the feasibility of the stormwater facility design shall be included in this section.

1. Underground injection control (UIC) well registration: DOE. Any proposed public UIC wells shall receive Washington State Department of Ecology UIC Program rule authorization prior to civil plan approval. Provide a copy of the authorization during the plan review process. A copy of the registration application will be accepted if rule authorization notification has not been received from Ecology within 60 days of application for well registration.

Response: There are no proposed UICs for this site. However, a Construction General Permit is required and a SWPPP has been prepared for submittal as a separate attachment to the City.

Section J – Conveyance Systems Analysis and Design

1. *Reference the conceptual drainage design proposed in the preliminary stormwater plan.*

Response: The conveyance system layout follows the same pattern as proposed in the Preliminary submittal. See 2.

2. *Identify revisions to the conceptual drainage design contained in the preliminary stormwater plan.*

Response: The proposed storm system layout is essentially the same. The significant difference is that the conceptual plan provided for a 'clean' and 'dirty' line for conveyance. The requirement for phosphorous treatment for lawn runoff to the streets has resulted in the McMaster Drive system in particular being a one line system. A number of Perk Filter™ have been added along the street to provide the treatment for this lot runoff.

3. *Identify the criteria used to complete the analyses and their sources.*

Response: Standard conveyance system design as presented in Camas Stormwater Design Standards Manual (CSDSM) was applied. The analysis was performed with HydroCAD software ® applying the Santa Barbara Urban Hydrograph (SBUH) method for runoff and routing analysis. A specific additional feature was applied to route flow an account for downstream affects such as tail water (TW) or backwater conditions. This feature provides a dynamic routing analysis – selected as calculation setting – Dyn-Stor-Ind for reach routing and Dyn-Stor-Ind for pond routing. This feature allows the model to access and account for downstream flow elevations on a dynamic basis. For this analysis, this was important in evaluation the proposed storm connections into the two existing cross culverts from wetland B to wetland A. The design determined that the outlet portion from the connection points required a pipe size change for each from 12 inch to 24 inch diameters. The modeling also determined that the proper balancing of wetland surfaces required an additional 24 inch pipe was required to connect the two existing culverts at this new manhole connection points.

4. *Identify and discuss initial conditions, including stream base flows, beginning water surface elevations, hydraulic or energy grade lines, beginning storage elevations, and other data or assumptions used to complete the analyses of initial conditions. Reference the sources of information.*

Response: This is not applicable in general, however, wetland A was assumed to have a specific water level. Cross sections were determined near the north property line of the site and several more for the remaining area from the site to Lacamas

Lake. The hydrology/hydraulics analysis routed the flow based on these added modeling features.

5. *Describe any assumptions used to complete the analyses.*

Response: Additional direct rainfall and other sources of inflow were not accounted for in the analysis beyond the north property line – would be the same for both the pre and post analysis - so it was assumed that the modeled results would only change by the same amount.

6. *Complete a detailed hydraulic analysis of all proposed collection and conveyance system elements and existing collection and conveyance elements, including outfall structures and outlet protection, that influence the design or are affected by the proposal, in accordance with Chapter 7 (Conveyance Systems) of this manual. Compute and tabulate the following:*

    a. *Identify design flows and velocities and conveyance element capacities for all conveyance elements within the development.*

        Response: See Appendix D.

    b. *Identify the 10 year recurrence interval stage for detention facility outfalls (See Chapter 7). Provide stage-frequency documentation from the continuous runoff model.*

        Response: Not Applicable as Flow Control was determined as not required.

    c. *Compute existing 100-year floodplain elevations and lateral limits for all channels, and verify no net loss of conveyance or storage capacity from development.*

        Response: The 100-yr flood plain does extend into the site generally in the wetland area. However, this is not a channelized condition where a rise in water level would occur or lateral limits would be affected. The flood plain is related to a large water body-Lacamas Lake, and this flooded area is all a backwater affect that proceeds and exceeds relative to the water level in the lake. A 100-yr runoff event from the site would not be occurring at in the same time frame of a 100-yr flood event in the Lacamas Creek/Lake system. Since the water surface in the lake at the 100-yr flood event is so large, the runoff that might be occurring from the site would have no net rise in the water surface and no net loss in any related conveyance.

    d. *Reference conveyance system elements to labeled points shown on the site location map or development plan.*

        Response: Each structure (junction point) and the branch system are referenced with structure IDs.

    e. *Verify the capacity of each conveyance system element to convey design*

flow and discharge at non-erosive velocities. Verify the capacity of the onsite conveyance system to convey design flows that result from ultimate build-out of upstream areas.

Response: See Appendix D. The design flow requirement is a 10-yr, 24-hr event. However, a 25-yr event summary was evaluated and presented for review. All main lines (except 2) are capable of conveying the 100-yr event in open channel conditions. The offsite upstream are was accounted for in an ultimate build-out condition, even though a few of the existing larger lot residences may remain and not be further divided.

f. Include and reference all hydraulic computations, equations, pipe flow tables, flow profile computations, charts, nomographs, detail drawings, and other tabular or graphic aids used to design and confirm the performance of conveyance systems.

Response: See Appendix D.

g. Summarize the results of system analyses, and describe how the proposed design meets the requirements of this chapter.

Response: The conveyance system design complies with CSDSM with a few noted exceptions-see Appendix D, D-2 in particular.

Basically, several lateral sizes of 6 and 8 inches at PerkFilter™ systems that have elevation constraints for making connection to the main storm line.

Section K – Off-site Analysis

If applicable, provide the results of an offsite analysis prepared in accordance with Chapter 9 (Offsite Analysis and Mitigation) of this manual. (See exemptions in Chapter 9.)

Response: See Appendix F.

Section L – Approval Conditions Summary

List each preliminary approval condition related to stormwater control, wetlands, floodplains, and other water-related issues, and explain how the final design addresses or conforms to each condition.

Explanation of how the Project meets the City Conditions of Approval Relating to Stormwater from NOTICE of DECISION - Parklands at Camas Meadows (file# SUB15-03) Effective Date of Decision: July 13th, 2016

#15 Prior to final engineering approval of any phase, the applicant shall demonstrate to the satisfaction of the city that the proposed direct release meets the criteria of 2.5.7 of the 2012 SMMWW, or provide an acceptable alternative regional stormwater treatment and flow control system as allowed in CMC 17.19.040 (C, 3a) that will serve both this project and the Village at Camas Meadows development south of the site, or provide a separate on-site stormwater treatment and flow control system to serve only the subject property.

Response: The applicant has worked with the City and Ecology to provide sufficient information demonstrating that the proposed direct release meets the criteria of 2.5.7 of the 2012 SMMWW. See the Final Storm TIR, Appendix B for more details and information on direct release and how criteria are met.

#16 If direct release of stormwater flows into Lacamas Lake is approved, prior to final plat approval of any phase the applicant shall ensure that an adequate and acceptable perpetual stormwater easement across the Camas Meadows Golf Course is in place and recorded with Clark County.

Response: The final design has no stormwater pipes or facilities crossing the Golf Course so a stormwater easement is not applicable. All stormwater from the site is released on the site into the wetland and leaves the site as shallow flow into the off-site contiguous wetland as currently occurs and has historically been conveyed.

#17 Stormwater runoff from the proposed lots and landscaped areas of the site shall be directed into the streets and/or into a stormwater treatment system that will provide adequate phosphorus removal from the yard and landscaped areas of the site prior to release into the wetlands.

Response: The majority or 84% of the site, which the individual lot lawn and landscaped areas, are being directed to the street and then to Perkilters. Treatment for this co-mingled flow achieves both adequate water quality treatment for phosphorus with 52% removal (minimum 50% removal), with a TAPE approved system element (PerkFilter) for water quality and phosphorus removal treatment. The PerkFiler system is rated by TAPE for 62.4% phosphorous load reduction.

As an additional voluntary measure to reduce the most likely phosphorus sources, all commercial pads and residential lots will be required by the HOA CC&R's to use only fertilizers that have a zero phosphorous designation. These restrictions will be recorded on all lots within the final approved CCR's for the site. These voluntary measures, if followed, will additionally reduce the amount of phosphorus leaving the site. However, phosphorus removal requirements for the entire site are met, even without this voluntary measure.

See Appendix C Water Quality, C-3a and C-3b for more detailed phosphorus removal calculations and analysis.

A Pollutant Loading Analysis (using two different approaches) has been provided that conservatively demonstrate 52% of the total phosphorus leaving the total site is removed, which satisfies the DOE requirement of 50% net phosphorus removal standard. Thus, the phosphorus reduction standard has been met when evaluating total phosphorus removed from the entire site.

#18 Stormwater lines serving the site not located within the public right-of-way will shall be placed within private stormwater easements and shall be maintained by the homeowners association.

Response: Private stormwater easements have been provided for all Stormwater lines on the site (not located within the public right-of-way). All private stormwater facilities shall be maintained by the property owners association or as otherwise agreed to by the City.

Section M – Special Reports and Studies

Where site-specific characteristics, such as steep slopes, wetlands, and sites located in wellhead protection areas, present difficult drainage and water quality design problems, the Director may require additional information or the preparation of special reports and studies that further address the specific site characteristics, the potential for impacts associated with the development, and the measures that would be implemented to mitigate impacts. Special reports shall be prepared by professionals with expertise in the particular area of analysis, who shall date, sign, stamp, and otherwise certify the report. Subjects of special reports may include, but are not be limited to:

1. *Geotechnical* – See Appendix G
2. *Wetlands* – See Appendix G
3. *Floodplains and Floodways* – A floodplain does extend into the site in a backwater condition. See comments in Section J, 6c.
4. *Groundwater* – Infiltration BMPs are not proposed.
5. *Structural Design – Design for wall sections is applicable –provided as separate document(s)*
6. *Fluvial Geomorphology (erosion and deposition)* - Not applicable.

All special reports and studies shall be included in the technical appendix.

Section N – Maintenance and Operations Manual

The project engineer shall prepare maintenance and operations manual for each stormwater control or treatment facility to be privately maintained, and for those that constitute an experimental system to be maintained by the City. The manual shall be written in an orderly and concise format that clearly describes the design and operation of the facility. The manual shall also provide an outline of required maintenance tasks; with the

recommended frequencies each task should be performed. The manual shall contain or reference procedures from the Stormwater Manual.

Response: A Maintenance and Operations Manual has been prepared for the Parklands Subdivision and the Archery Business Park. See Appendix H and Section L, responses to 3 and 4.

APPENDIX A

A-1 GIS Development Packet

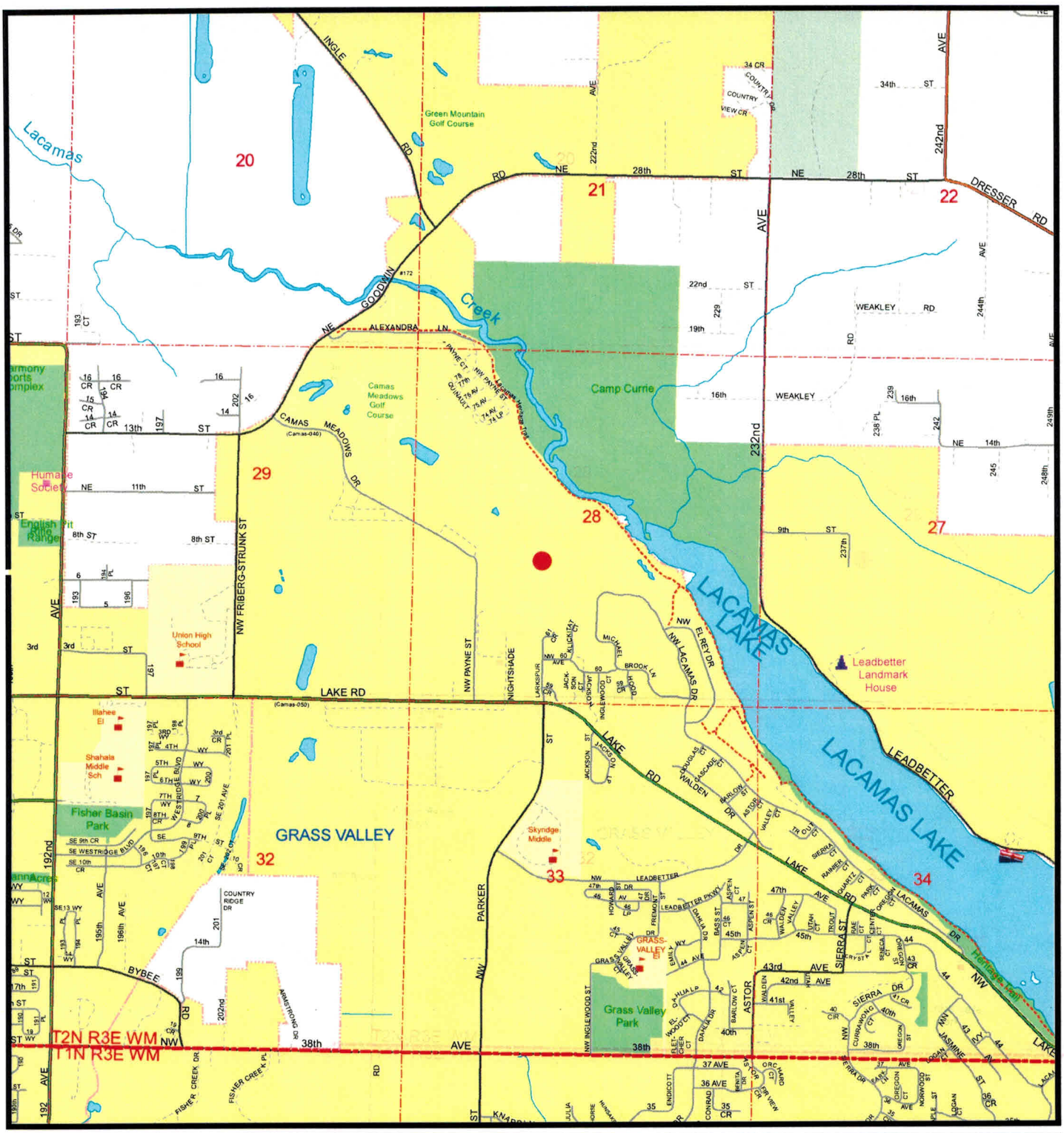
A-2 FIRM Map

A-3 Historic Basin Maps

1) **Fig. 1A Historic Basin Map**
2) **Fig 1B Historic Basin Map – add projects**
3) **Fig 2A Project Areas**
4) **Fig 2B Soils Map**
5) **Fig 3 Post Subbasin Map**

A-4 Selected Soils Data

A-5 Isopluvial Maps



General Location Map

Printed on: February 04, 2015

Account No: 175948000, 986031650
Owner: CHINOOK LAND OWNERS GROUP LLC
Address: 1400 NW 63RD ST
C/S/Z: VANCOUVER, WA 98663

Subject Property Location

CLARK COUNTY, WASHINGTON
Geographic Information System

1:24,000

0 0.1 0.2 0.3 0.4 0.5 Miles

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Property Information Fact Sheet

Mailing Information:
Account No.: 175948000, 986031650
Owner: CHINOOK LAND OWNERS GROUP LLC
Address: 1400 NW 63RD ST
C/S/Z: VANCOUVER, WA 98663
Assessed Parcel Size: 36.43 Ac
Property Type: UNUSED LAND TIMBERED.

PARCEL LOCATION FINDINGS:

Quarter Section(s): SE 1/4,S28,T2N,R3E,
SW 1/4,S28,T2N,R3E
Municipal Jurisdiction: Camas
Urban Growth Area: Camas
Zoning: BP, R-15
Zoning Overlay: PlannedIndustrialDevelopmentOverlay
Comprehensive Plan Designation: IND,
SFL
Columbia River Gorge NSA: No Mapping Indicators
Building Moratorium: No Mapping Indicators

Late-Comer Area: No Mapping Indicators
Trans. Impact Fee Area: Camas
Park Impact Fee District: No Mapping Indicators
Neighborhood Association: No Mapping Indicators
School District: Camas
Elementary School: Grass Valley
Junior High School: Skyridge Middle
Senior High School: Camas
Fire District: Camas Washougal FD
Sewer District: Camas
Water District: None
Wildland: No Mapping Indicators
Historic Sites: No Mapping Indicators

ENVIRONMENTAL CONSTRAINTS:

Soil Type(s): CvA, 21.3% of parcel
HcB, 2.1%
HcD, 67.0%
HcE, 0.4%
LeB, 9.2%
Hydric Soils: Hydric, 21.3% of parcel
Non-Hydric, 78.7%
Flood Zone Designation: 500 Year Flood Area,
Floodway Fringe,
Outside Flood Area
CARA: Category 2 Recharge Areas
Liquefaction Susceptibility: Very Low
NEHRP: C
Slope: 0 - 5 percent, 56.2% of parcel
10 - 15 percent, 12.5%
15 - 25 percent, 2.9%
5 - 10 percent, 28.4%
Landslide Hazards: Slopes > 15%
Slope Stability: No Mapping Indicators
Priority Habitat and Species Areas: Riparian Habitat Conservation Area,
Species
Priority Species Area Buffer: WDFW Priority Species Buffer
Priority Habitat Area Buffer: No Mapping Indicators
Archeological Predictive: High, 85.2% of parcel
Moderate-High, 14.8%
Archeological Site Buffers: Mapping Indicators Found

NOTE
This data is compiled from many sources and scales. Clark county makes this information available as a service, and accepts no responsibility for any inaccuracy, actual or implied.



CLARK COUNTY, WASHINGTON
Geographic Information System

N

1:3,600

0 150 300 450 Feet

2014 Aerial Photography with Contours

Account No: 175948000, 986031650
Owner: CHINOOK LAND OWNERS GROUP LLC
Address: 1400 NW 63RD ST
C/S/Z: VANCOUVER, WA 98663

Proposed Development Area
2' Elevation Contours

Printed on: February 04, 2015

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Developer's GIS Packet: Page 5 of 15

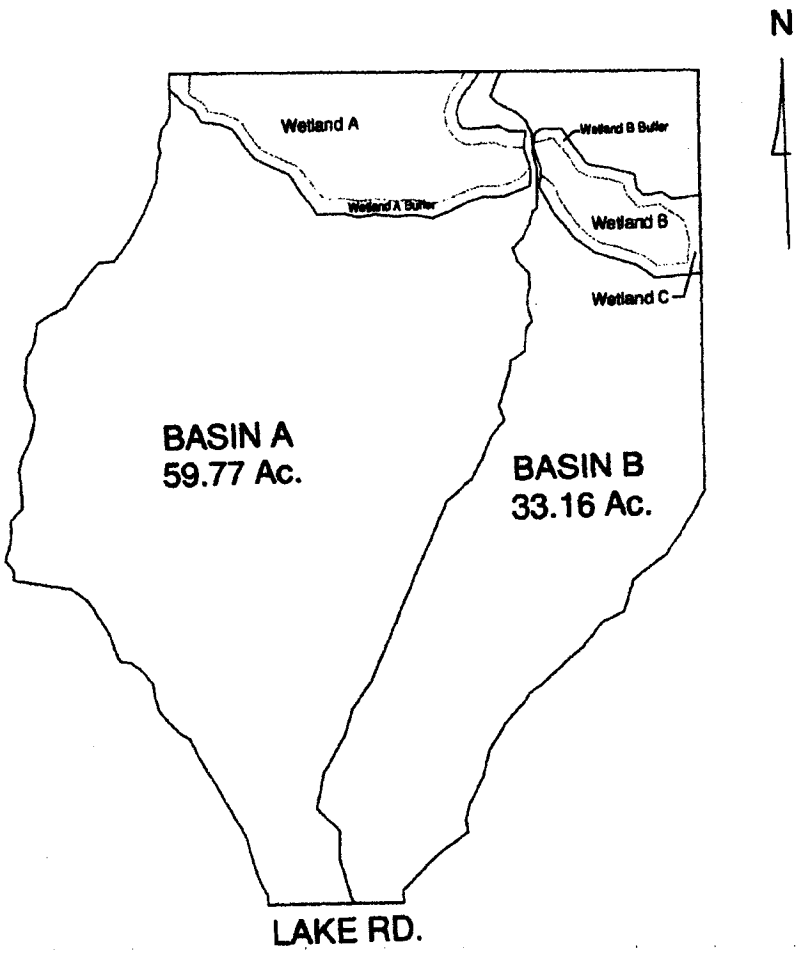


FIG. 1A HISTORIC BASIN MAP

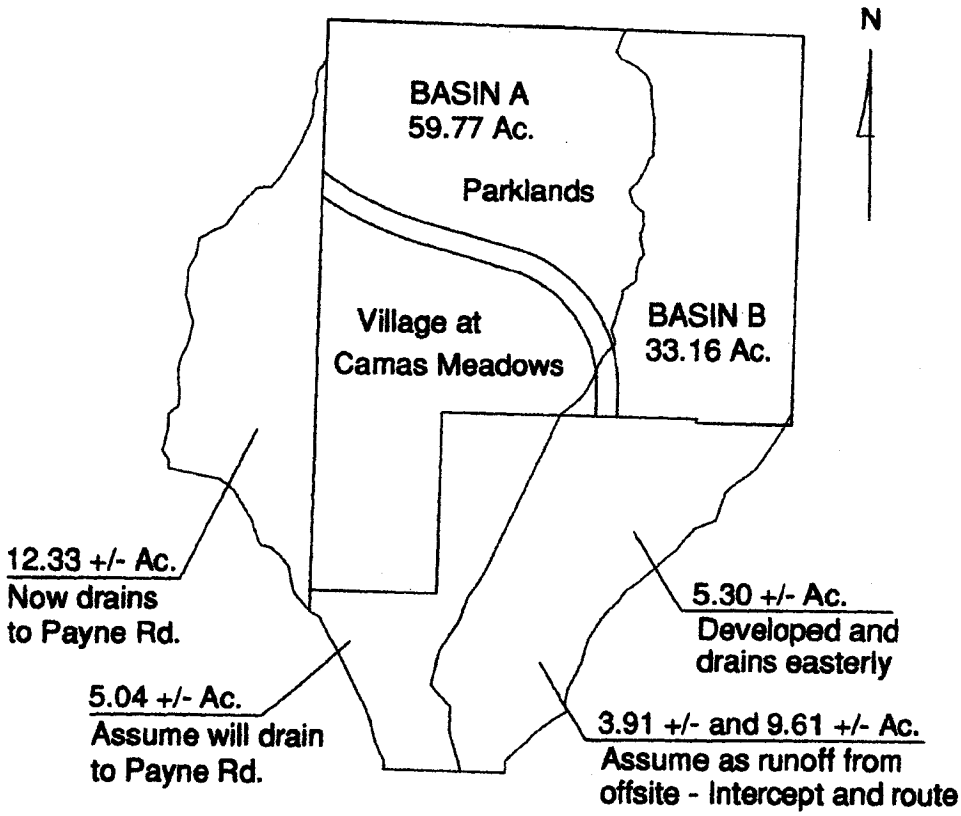


FIG. 1B HISTORIC BASIN MAP

- add PROJECTS

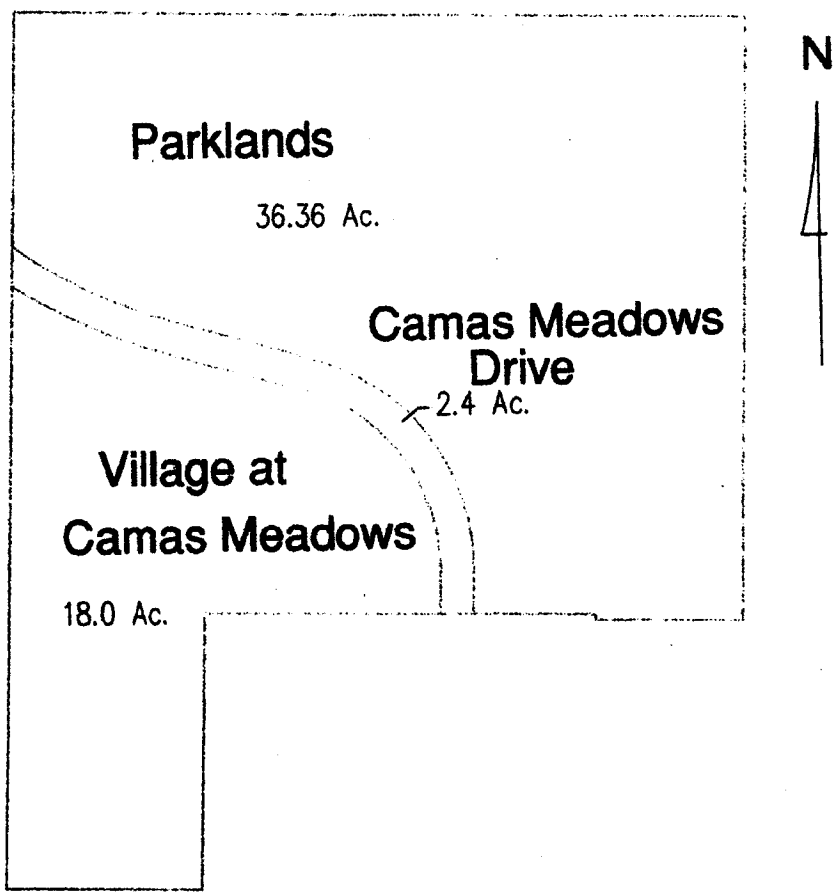


FIG. 2A PROJECT AREAS

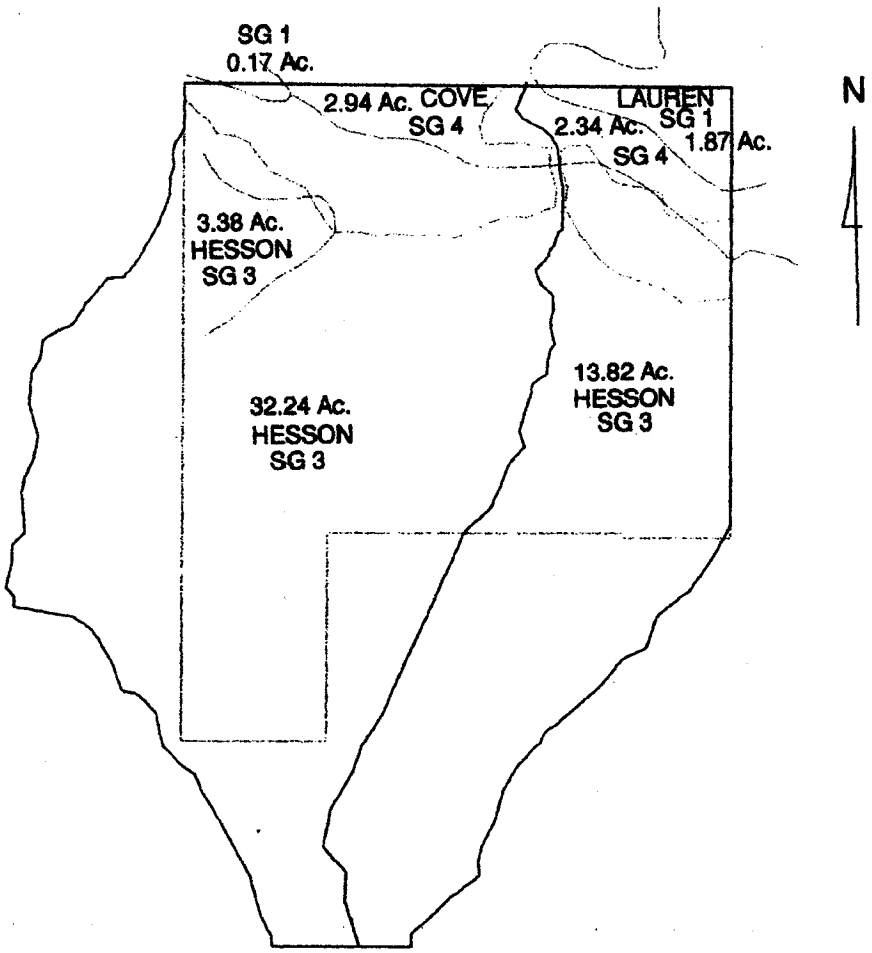


FIG. 2B SOILS MAP

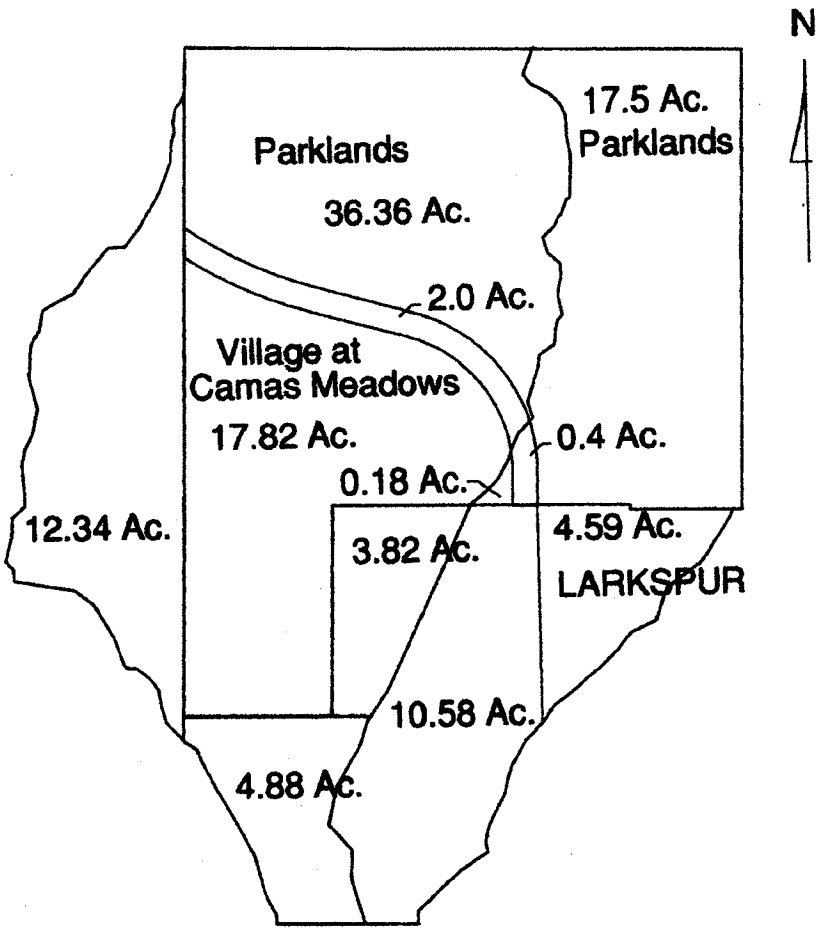


FIG. 1C HISTORIC BASIN MAP
- add PROJECTS

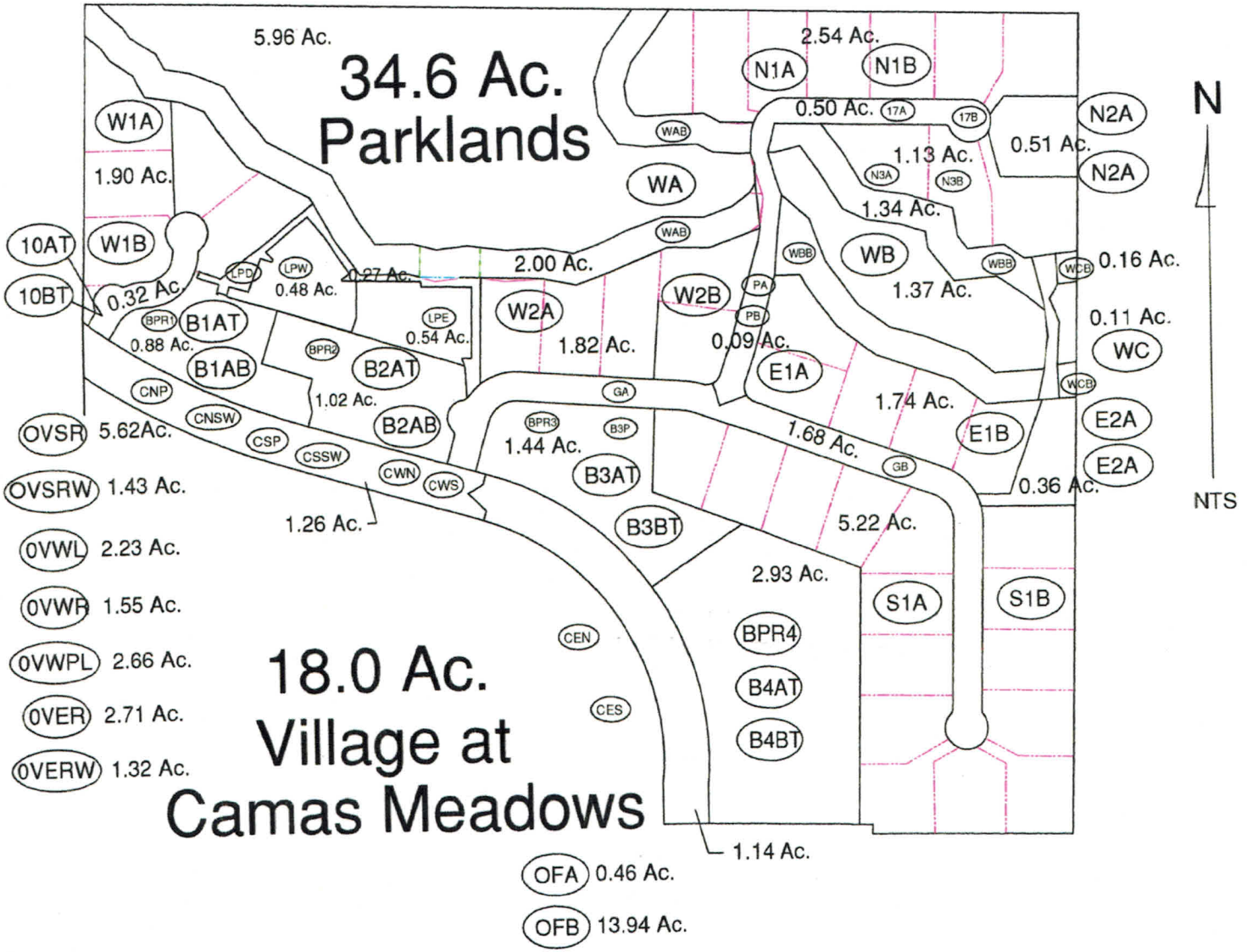


FIG. 3 - POST SUBBASIN AREAS

Exhibit 16 SP26-1005

SOIL INFORMATION

– selected text from USDA Soil Survey report of Clark County, Washington issued November 1972

See Geotech Report, Appendix E

- See page 10 for table with depth to bedrock information.

Cove Series

– selected text from USDA Soil Survey report of Clark County, Washington issued November 1972.

The Cove series consists of deep, very poorly drained, mostly nearly level soils (fig. 3). These soils have a clayey subsoil. They formed in water-laid deposits in old lakes and ponds. The native vegetation is deciduous trees, sedges, reeds, and water-tolerant shrubs and grasses.

Cove soils are used primarily for pasture.

Cove silty clay loam, 0 to 3 percent slopes (CvA).—This soil is in concave drainageways and in large, flat, old lakebeds. The slope is generally less than 1 percent.

In a typical profile the surface layer is very dark gray silty clay about 4 inches thick. Below this is firm clay about 32 inches thick. It is black in the upper part and very dark gray and mottled in the lower part. The underlying material, to a depth of 54 inches, is mottled, light olive-gray gravelly silty clay loam.

Included in mapping were small areas where the surface layer is gravelly silt loam, silty clay, or clay. Also included were areas where the subsoil is gravelly clay.

This soil is very poorly drained and very slowly permeable. Tillage is difficult. The available water capacity and fertility are low. The effective rooting depth averages less than 15 inches. Surface runoff is very slow, and ponding is common in winter unless drainage is provided. There is no hazard of erosion.

Water-tolerant grasses and legumes are well suited, but these plants must also resist drought because this soil is droughty in summer. Tall fescue, meadow foxtail, birdsfoot trefoil, and white Dutch clover are suited grasses and legumes

Hesson Series

– selected text from USDA Soil Survey report of Clark County, Washington issued November 1972.

The Hesson series consists of deep, well-drained soils that are mostly level to gently rolling. Some areas are hilly and very steep. These are moderately fine textured soils that have a fine textured subsoil. The parent material is deeply weathered, mixed old alluvium that contains varying amounts of gravel. The original vegetation is a heavy growth of Douglas-fir and a scattering of western redcedar and grand fir. The understory consists principally of vine maple, salal, Oregongrape, ferns, and red huckleberry.

All the acreage has been logged. Areas not in cultivation are in second-growth timber. The understory is similar in composition to that of the native stands. Red alder is dominant in some areas. The annual precipitation ranges from 50 inches to more than 60 inches.

Hesson clay loam, 0 to 8 percent slopes (HcB).-This is the dominant soil of the high terraces along the mountain foot slopes in the county. In most places the slope is 2 to 5 percent. The relief is undulating. Slopes are generally short to moderate in length.

SOIL INFORMATION

– selected text from USDA Soil Survey report of Clark County, Washington issued November 1972

In a typical profile the surface layer is dark reddish brown clay loam about 8 inches thick. The subsurface layer is dark reddish-brown clay loam about 4 inches thick. Below this layer is friable, dark reddish-brown clay loam about 10 inches thick. The next layer, to a depth of about 91 inches, is reddish-brown clay. In sequence from the top, the uppermost 18 inches is friable, the next 39 inches is firm, and the lower 12 inches is very firm.

Included in mapping were some areas that are nearly level or are slightly depressional and have a slightly mottled layer at a depth of 30 to 40 inches. This indicates reduced permeability and a temporary perched water table during rainy periods.

This soil is well drained and has moderately slow permeability. The available water capacity is high, and fertility is moderate. Problems arise in the proper scouring of tillage equipment when the soil is worked at about field capacity. Tillage is difficult when the surface layer is nearly dry. Surface runoff is slow, and the erosion hazard is slight.

Hesson clay loam, 8 to 20 percent slopes (HcD).-This soil is similar to Hesson clay loam, 0 to 8 percent slopes, except that the surface layer generally is 1 to 2 inches thinner. In places where erosion has been active, the surface layer is 2 to 4 inches thinner. The slopes are generally single and are moderate in length.
Most areas of this soil are cleared and in cultivation, but use is less intensive than on Hesson clay loam, 0 to 8
percent slopes. Runoff is medium, and the erosion hazard is moderate where the surface is left bare in winter.

Lauren Series
– selected text from USDA Soil Survey report of Clark County, Washington issued November 1972.

The Lauren series consists of deep, somewhat excessively drained, nearly level to gently sloping soils on terraces 50 to 300 feet above the Columbia River. In a few places, on terrace fronts, the soils are steep to very steep. These are very gravelly soils that formed in mixed Columbia River alluvium that contained some volcanic ash. Lauren soils are in the southwestern part of the county, in the vicinity of Mill Plain, Orchards, and Fourth Plain. The original vegetation was Douglas-fir, grand fir, bigleaf maple, vine maple, salal, and ferns. The average annual precipitation is about 48 inches.

Nearly all the acreage is cleared and in cultivation or suburban development. There are a few stands of second growth Douglas-fir in farm woodlots.

Lauren gravelly loam, 0 to 8 percent slopes (LgB).-This soil occurs on terraces. The slopes are generally less than 4 percent and approach 8 percent only along the terrace breaks.
In a typical profile the surface layer is very dark brown gravelly and very gravelly loam about 20 inches thick. Below the surface layer is friable, dark-brown very gravelly loam about 13 inches thick. The next layer is dark-brown very gravelly coarse sandy loam about 11 inches thick. The underlying material, to a depth of 70 inches, is dark-brown very gravelly loamy coarse sand.

Included in mapping were a few small areas where very gravelly loamy coarse sand is within 30 inches of the surface.This soil is somewhat excessively drained and easily tilled. Permeability generally is

SOIL INFORMATION

– selected text from USDA Soil Survey report of Clark County, Washington issued November 1972

moderately rapid, but it is rapid in the substratum. The available water capacity is moderate. Fertility is moderate. Surface runoff is slow, and the erosion hazard is slight.

Note: This geotech report by Columbia West Engineering, Inc. reports the following.

> *The Web Soil Survey (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2013 Website) indicates the site is underlain by three soil types. Hesson clay loam soils are mapped on the majority of the site from the northwest corner to the southwest corner of the property, while Cove silty clay loam and Lauren gravelly loam soils are mapped in the northern and northwestern portions of the property, respectively. Soils resembling the Lauren series were not encountered during subsurface excavation.**
>
> *Although actual on-site soils may vary from the broad USDA descriptions, Lauren soils are generally coarse-textured, well drained soils with rapid permeability. Cove soils are generally fine-textured, poorly drained soils with very slow permeability and high shrinkswell potential. Hesson soils are fine-textured, well drained soils with moderately slow permeability and moderate shrink-swell potential.*
>
> * Review of the report reveals that TP1 and TP 2 were explored in this area of the site. Poorly graded GRAVEL with silt and sand was observed. Refusal was within 2.5 to 3 feet of the surface.

Permeability: Cove soils are at the wetland and listed at less than 0.06 in/hr in the 0-36 inch depth. Hesson soils located south of the wetlands and listed at less than 0.63 to 2.0 in/hr in the 0-22 inch depth.

This indicates that some infiltration will occur at the proposed biorention facilities even though the majority will be collected in underdrain systems and conveyed in the storm system piping.
Also, some infiltration may occur at the proposed systems in the wetland buffers – not significant.

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	4. 5–6. 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

Figure A-2: 2-Year, 24-Hour Clark County Isopluvial Map

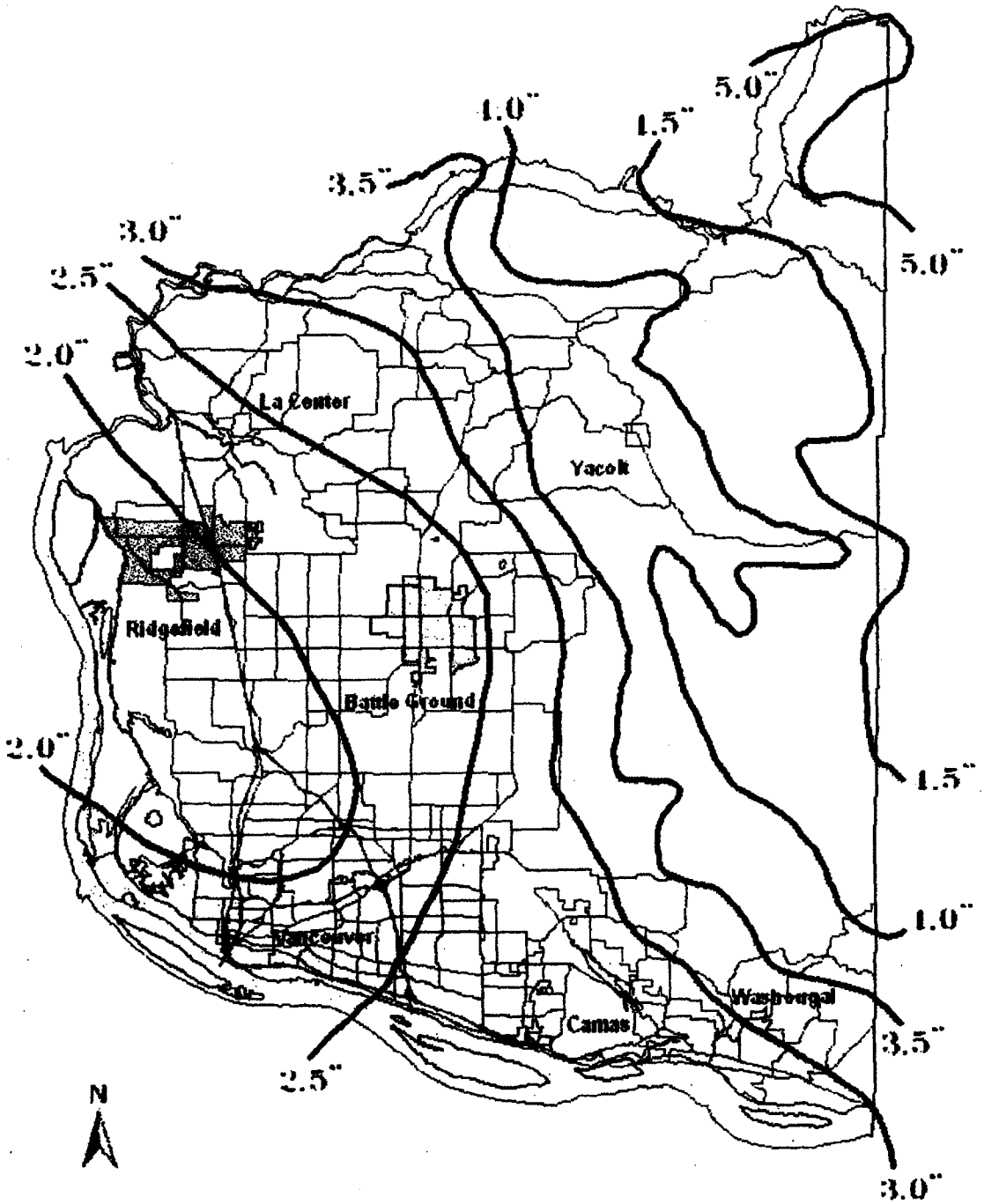


Figure A-3: 10-Year, 24-Hour Clark County Isopluvial Map

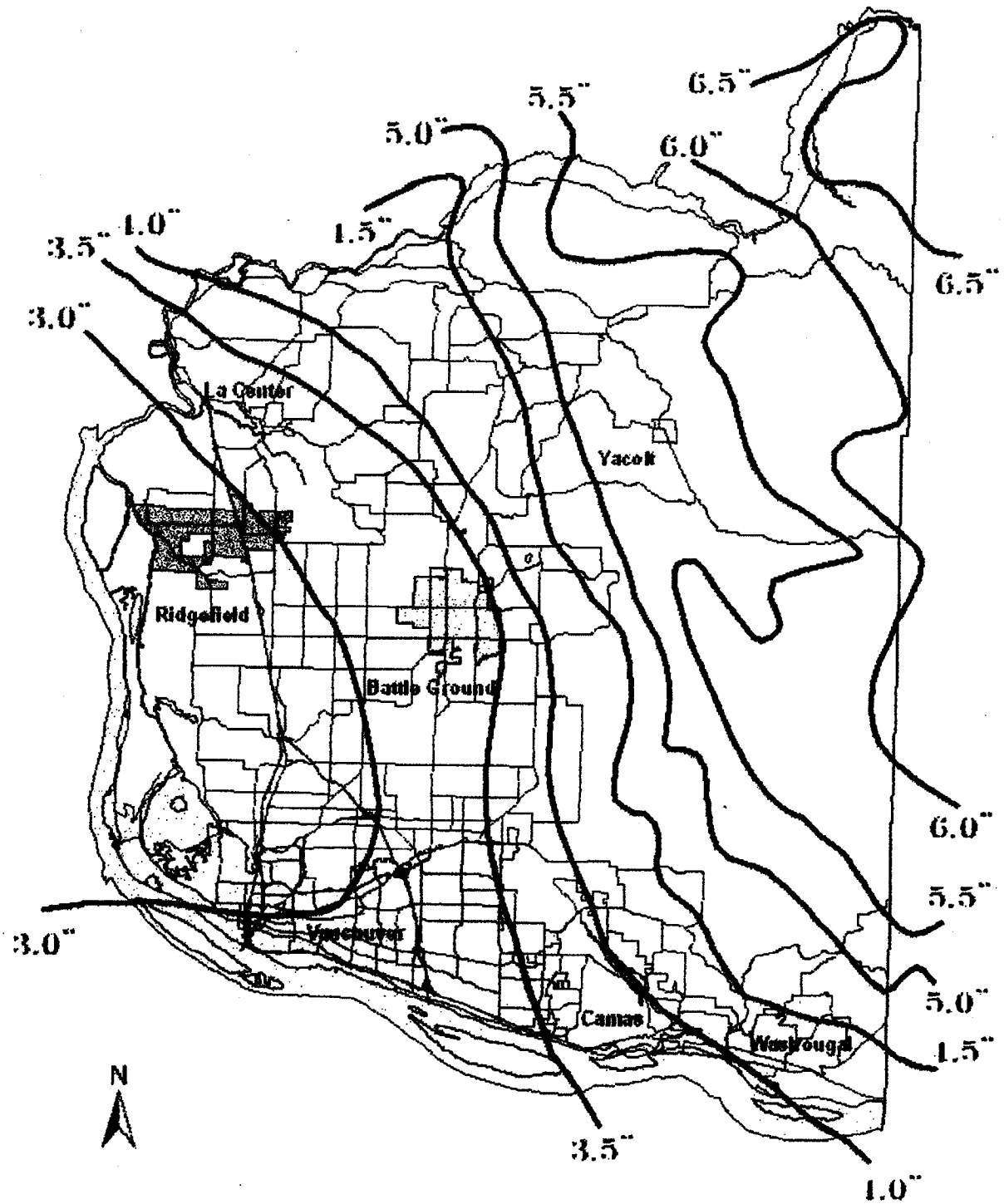


Figure A-4: 25-Year, 24-Hour Clark County Isopluvial Map

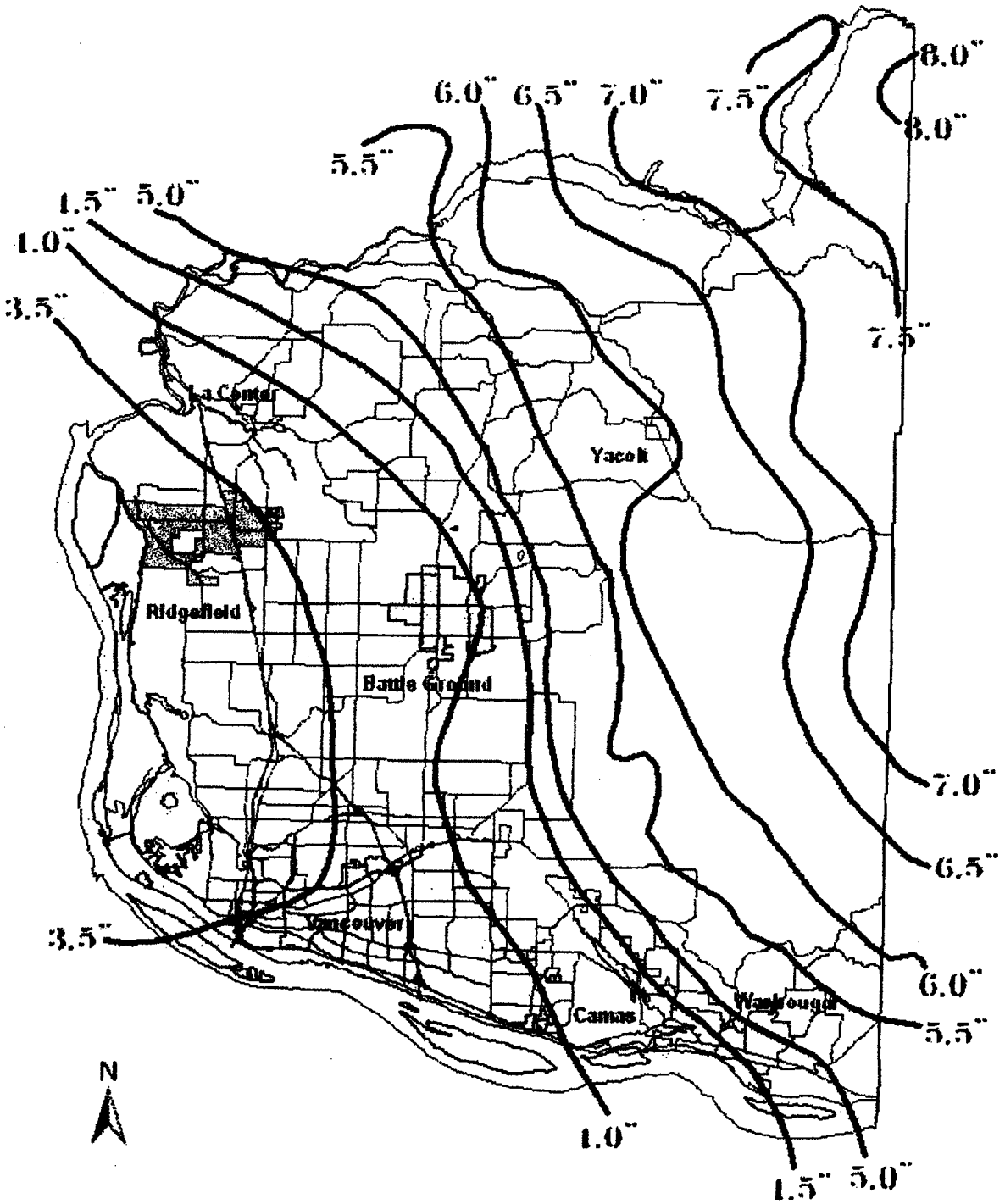
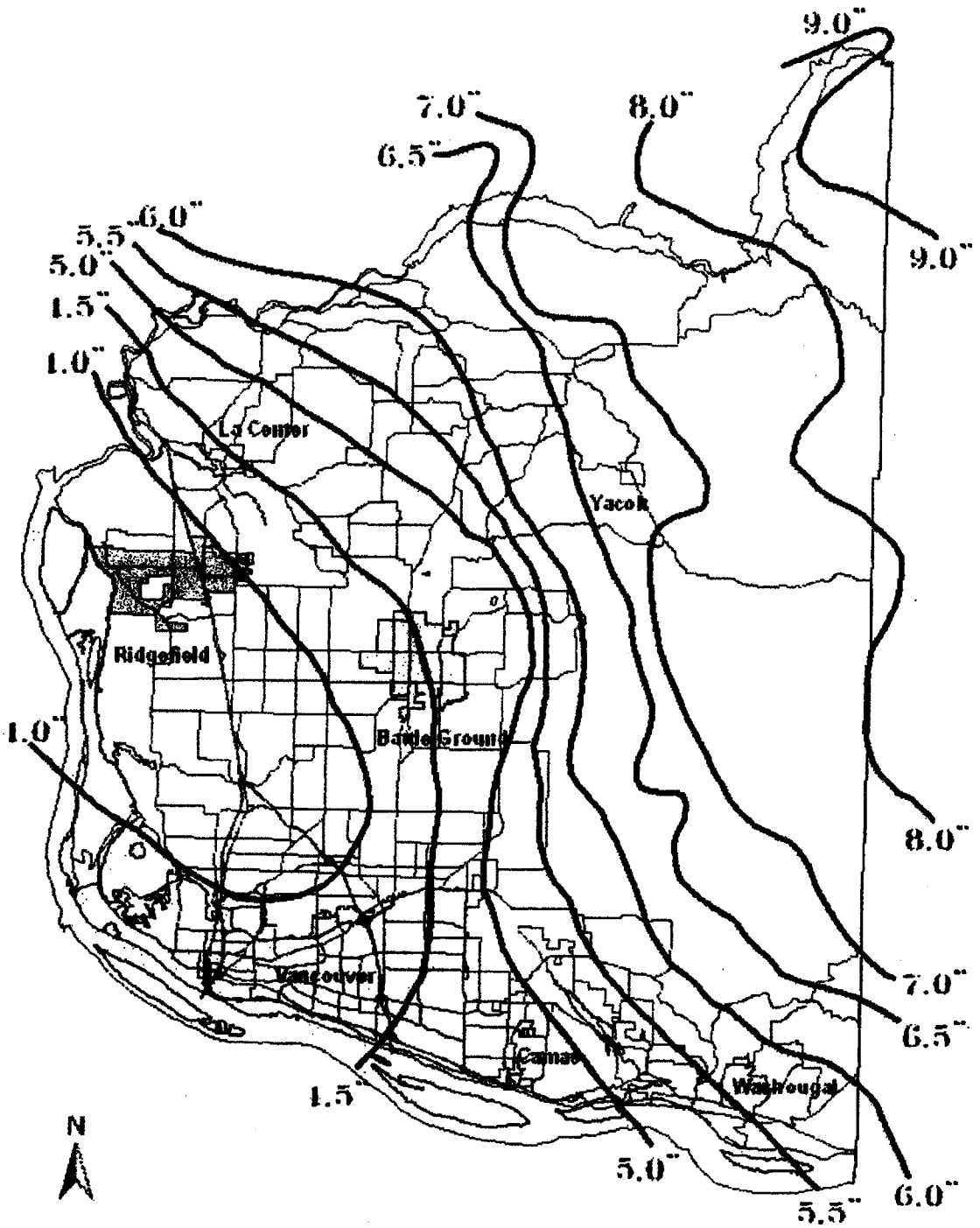


Figure A-5: 100-Year, 24-Hour Clark County Isopluvial Map



APPENDIX B

B-1 Minimum Requirements #1 -#9 Responses

B-2 MR #8 Wetlands Protection Evaluation

B-2a Support files for Hydroperiod Evaluation

B-2b MR #8 Annual WLF Comparison

B-2c MR #8 Monthly WLF Comparison

B-3 MR #7 Flow Control

APPENDIX B-1

Section B (REPORT) - MINIMUM REQUIREMENTS #1-#9 - RESPONSES

Section B – Minimum Requirements

The "**Parklands Executive Residential Subdivision and Parklands Business Park**" proposal contains three threshold discharge areas (TDAs) which are subject to minimum requirements 1 – 10.

1. **Preparation of Stormwater Site Plans**

   Finalized.

2. **Construction Stormwater Pollution Prevention**

   A SWPP will be prepared for implementation. An erosion control plan will be part of the construction plan set.

3. **Source Control of Pollution**

   See Final TIR, Section D – Source Control

4. **Preservation of Natural Drainage Systems and Outfalls**

   There are no existing onsite drainage systems of significance for the overland flow to the wetland areas. See continued discussion under next Minimum Requirement.

5. **Onsite Stormwater Management**

   See Final TIR, Section E – Onsite Stormwater Management BMPs

6. **Runoff Treatment**

   See Final TIR, Section F – Runoff Treatment and Design

7. **Flow Control**
   See Final TIR, Section G – Flow Control Analysis and Design

8. **Wetlands Protection**

   See Final TIR, Section I – Wetlands Protction

Basin/Watershed Planning

Not applicable per Camas Stormwater Manual.

APPENDIX B-1

Section B (REPORT) - MINIMUM REQUIREMENTS #1-#9 - RESPONSES

9. Operation and Maintenance

An Operation and Maintenance procedure document has been developed to include City of Camas procedures and processes. The Clark County Stormwater Facility Maintenance Manual and DOE references are also be referred to for additional or appropriate procedures.

APPENDIX B-2 MINIMUM REQUIREMENT # 8 WETLAND PROTECTION EVALUATION FOR COMPLIANCE

Our evaluations for Minimum Requirement #8 Wetland Protection is based on the following reference and the applicable section.

Appendix 1-D Wetlands and Stormwater Management Guidelines

Guide Sheet 2B: Guidelines for Protection from Adverse Impacts of Modified Runoff Quantity Discharged to Wetlands

Per our conference call with DOE, several City staff, and their consultant, we understand that since this wetland is not classified as category 1 or 2, the provision for wetland protection is subject to whether or not the City determines protection is required and to what extent. We are proposing to meet water quality protection, implement erosion control practices, and provide the required wetland buffers.

We have already provided extensive analysis related to protection of elements related to hydroperiod. Our approach has been made relative to determining the hypothetical differences between a continuous model based on existing conditions and one based on future full build conditions for the watershed with runoff to this portion of the wetland – the portion receiving inflow from our site. This analysis is described in the above reference as follows:

> "*This analysis hypothesizes a fluctuating water stage over time before development that could fluctuate more, both higher and lower after development; these greater fluctuations are termed* ***stage excursions****. The guidelines set limits on the frequency and duration of excursions, as well as on overall water level fluctuation, after development."*

There are two descriptions presented for determining existing hydroperiod data. The first or preferred process is not fully practical, as it is based on

> *"the model being calibrated with at least one year of data taken using a continuously recording level gage under existing conditions and should be run for the historical rainfall period."*

This analysis would be limited to a one year evaluation as the post full build model would need to be based on the same temperature, rainfall data, etc. for the comparison. The second description is more representative of the approach that has been applied to date for this analysis. Although the first portion is still proposing data gathering for a period of time, the evaluation of the data is more in line with the approach undertaken in our analysis.

APPENDIX B-2 MINIMUM REQUIREMENT # 8 WETLAND PROTECTION EVALUATION FOR COMPLIANCE

The following information seems to be the most applicable criteria for evaluating the hydroperiod responses for this sloped wetland.

2. The following hydroperiod limits characterize wetlands with relatively high vegetation species richness and apply to all zones within all wetlands over the entire year. If these limits are exceeded, then species richness is likely to decline. If the analysis described above forecasts exceedences, one or more of the management strategies listed in step 5 should be employed to attempt to stay within the limits.

   - Mean annual Water Level Fluctuations (WLF) (and mean monthly WLF for every month of the year) does not exceed 20 cm (8 inches or 0.66 ft). Vegetation species richness decrease is likely with: (1) a mean annual (and mean monthly) WLF increase of more than 5 cm (2 inches or 0.16 ft) if pre- development mean annual (and mean monthly) WLF is greater than 15 cm, or (2) a mean annual (and mean monthly) WLF increase to 20 cm or more if pre-development mean annual (and mean monthly) WLF is 15 cm (6 inches or 0.5 ft) or less.

Finding: The evaluation for the mean annual WLF and mean monthly WLF for every month of the year has been completed for the 60-yr span from 1948 through 2008. The results have also been arranged from highest WFL to lowest WLF for these two evaluations.

- **The largest mean annual WLF is 0.10 inches or 0.008 ft (significantly less than the allowed 8 in or 0.66 ft) and the largest mean monthly WLF is 0.43 inches or 0.036 ft (significantly less than the allowed 6 inches or 0.5 ft).**

See separate files:

MR#8-01 Annual Mean Average Values – compare Water Level Fluctuations (WLF)
MR#8-02 Monthly Mean Average Values – compare Water Level Fluctuations (WLF)

   - The frequency of stage excursions of 15 cm above or below pre- development stage does not exceed an annual average of six.
     Note: A short-term lagging or advancement of the continuous record of water levels is acceptable. The 15 cm limit applies to the temporary increase in maximum water surface elevations (hydrograph peaks) after storm events and the maximum

APPENDIX B-2 MINIMUM REQUIREMENT # 8 WETLAND PROTECTION EVALUATION FOR COMPLIANCE

decrease in water surface elevations (hydrograph valley bottoms) between events and during the dry season.

Finding: There are no stage excursions of 15 cm (6 inches or 0.5 ft) above or below pre - development stage based on site modeling results.

The duration of stage excursions of 15 cm above or below pre- development stage does not exceed 72 hours per excursion. Note: A short-term lagging or advancement of the continuous record of water levels is acceptable. However, the 15 cm limit applies throughout the entire hydrograph, not just the peaks and valleys.

- The total dry period (when pools dry down to the soil surface everywhere in the wetland) does not increase or decrease by more than two weeks in any year.
- Alterations to watershed and wetland hydrology that may cause perennial wetlands to become **vernal** are avoided.

Finding: There is no duration of stage excursions of 15 cm (6 inches or 0.5 ft) above or below pre- development stage based on site modeling results.

Other files (separate document) used to develop the input for modeling:

1. **Site Background Info**
2. **May 11, 2016 Field Observations**
3. **Cross section locations – outflow route**
4. **HCAD – Control Cross Section for Wetland – WWHM input to SDD Table**
5. **HCAD Single Event Hydrograph Plot**

Summary:

- **The modeled largest mean annual WLF and the largest mean monthly WLF are both significantly less than the allowed limits.**
- **Modeling results of the site for both stage excursions, and duration of stage excursions, all fall well within the allowed limits above or below pre-development stage.**
- **Based on these results, the site can or does meet the requirements of Minimum Requirement #8 – Wetland Protection Evaluation for Compliance.**

APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION

1. Site Background Info – The Parklands in Camas, WA

There are 42 proposed residential lots of 15,000 sf minimum and the remainder as a business park. The offsite area from the south is a mix of residential and multi-unit housing. The road section between the two projects is about 2.4 acres.

There are three wetland portions for the onsite wetland designated as wetland A, Wetland B, and wetland C. Wetland A and B are separated by a road crossing with two 12 inch culverts and wetland B and C are separated by a road crossing with two 12 inch culverts.

Wetland A: 5.97 acres
Wetland B: 1.37 acres
Wetland C: 0.11 acres
7.44 acres total

The wetland buffer is 50 ft wide and includes another 3.5 acres. The remaining site area is 25.42. Another project (approx. 18 acres) is under review and an area to the west of about 14 acres has been accounted for as future development.

Note: The existing condition areas and post-development full build contributing areas are listed in file MR#8-01 Annual Mean Average Values – compare Water Level Fluctuations (WLF). The project basin maps represent the delineation of these contributing areas.

The site is underlain with sandstone and refusal varied from 3 ft to 6.5 ft at seven locations. The wetland continues (as a contiguous wetland) north for approximately another 600 feet to Lacamas Lake. The offsite portion is about 900 ft wide and is mostly reed canary grass and some wooded area before entering the Lake.

APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION

2. May 11, 2016 Field Observations



Looking north from site – large rockery wall at right side of flow path (along edge of golf green)



Looking back at site – rockery wall now on left side of flow path – view from cart path crossing

APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION



Looking north toward lake from cart path crossing – rockery wall again along golf course with flow path at left



Closer view of rockery and flow path at rockery

APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION



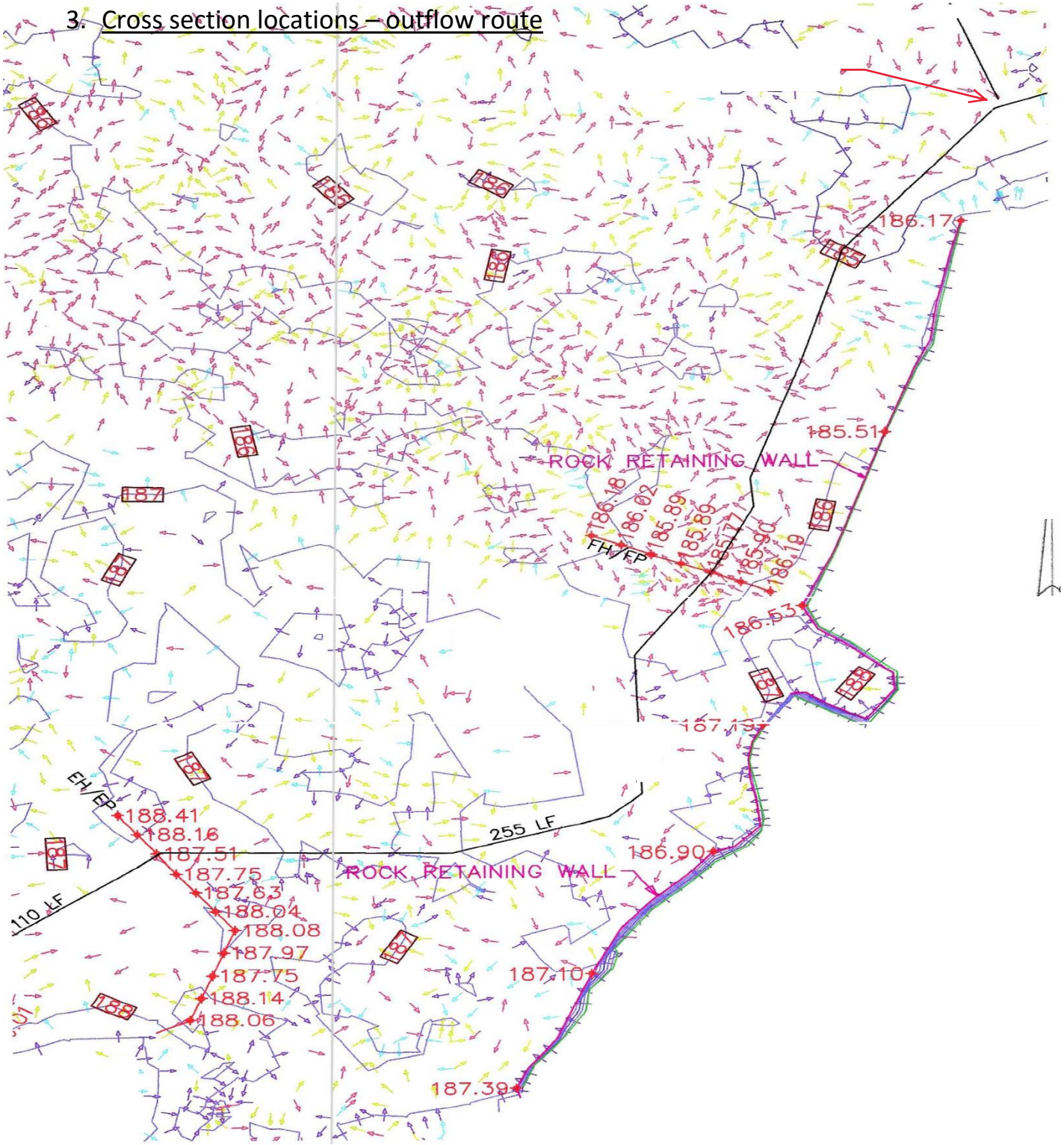
Same area along rockery wall



Outlet to Lacamas Lake – later determined there are two outfall locations – the other is 190 ft to the east.

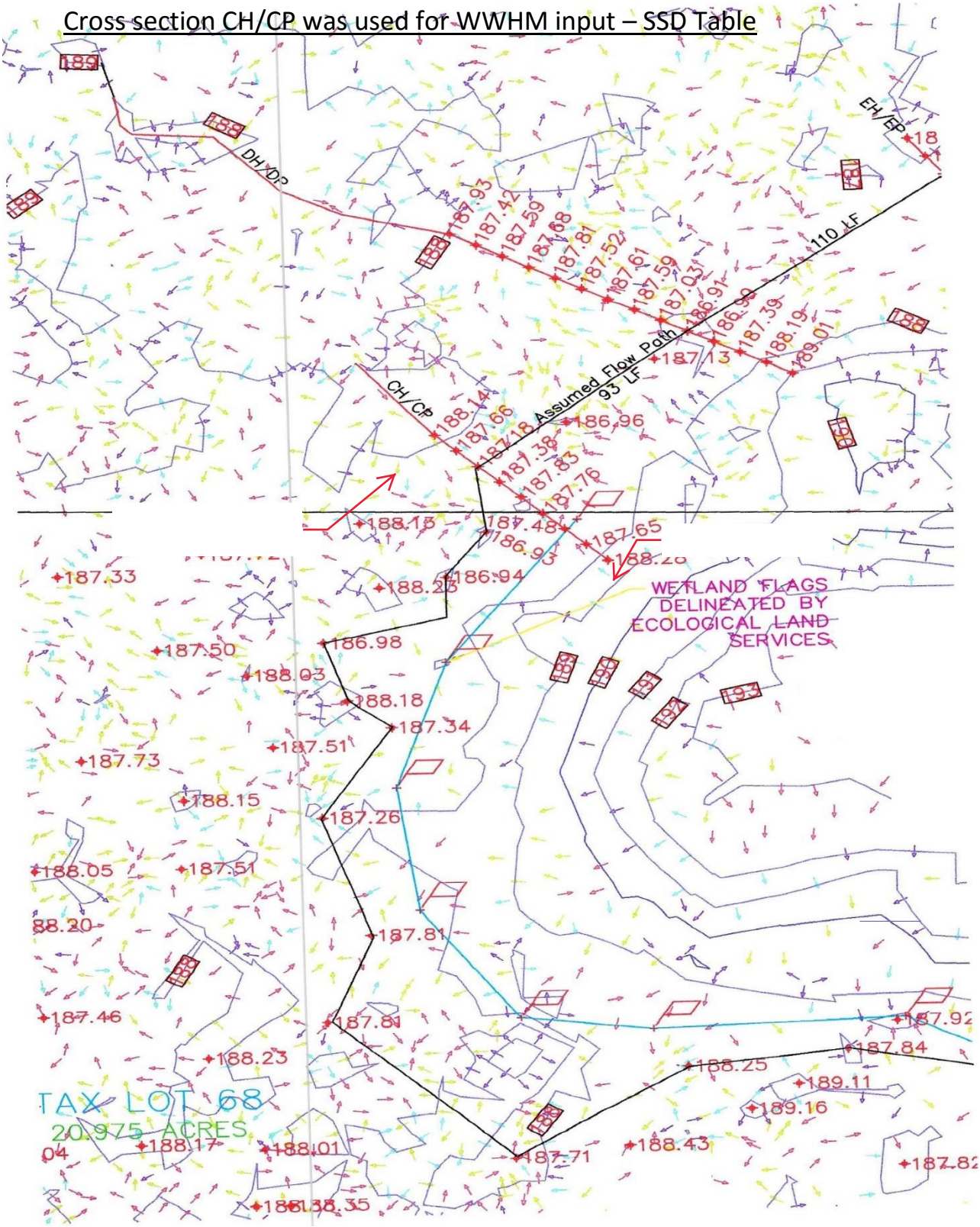
APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION

3. Cross section locations – outflow route



APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION

Cross section CH/CP was used for WWHM input – SSD Table



APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION

4. HCAD – Control Cross Section for Wetland – WWHM input to SDD Table

Parklands - per Survey *Type IA 24-hr 100-yr Rainfall=5.30"*
Prepared by Hewlett-Packard Company Printed 7/21/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

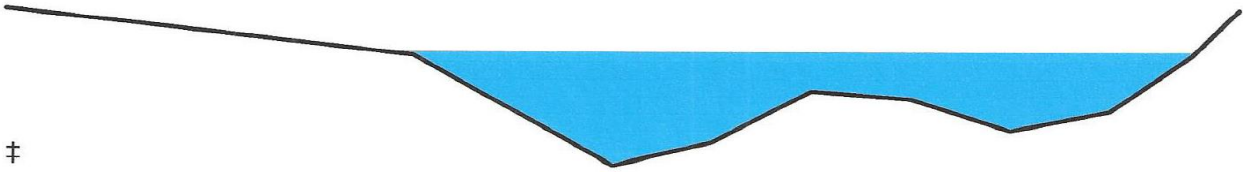
Summary for Reach CH: outflow from site

Inflow Area = 92.930 ac, 0.00% Impervious, Inflow Depth = 3.05" for 100-yr event
Inflow = 27.77 cfs @ 11.07 hrs, Volume= 23.638 af
Outflow = 27.76 cfs @ 11.15 hrs, Volume= 23.638 af, Atten= 0%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3
Max. Velocity= 0.65 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 5.2 min

Peak Storage= 3,992 cf @ 11.11 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.35' Flow Area= 79.4 sf, Capacity= 59.05 cfs

Custom cross-section, Length= 93.0' Slope= 0.0029 '/' (101 Elevation Intervals)
Constant n= 0.080 Earth, long dense weeds
Inlet Invert= 187.18', Outlet Invert= 186.91'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-41.00	188.53	0.00
0.00	188.14	0.39
10.00	187.66	0.87
20.00	187.18	1.35
30.00	187.38	1.15
40.00	187.83	0.70
50.00	187.76	0.77
60.00	187.48	1.05
70.00	187.65	0.88
78.30	188.14	0.39
83.00	188.53	0.00

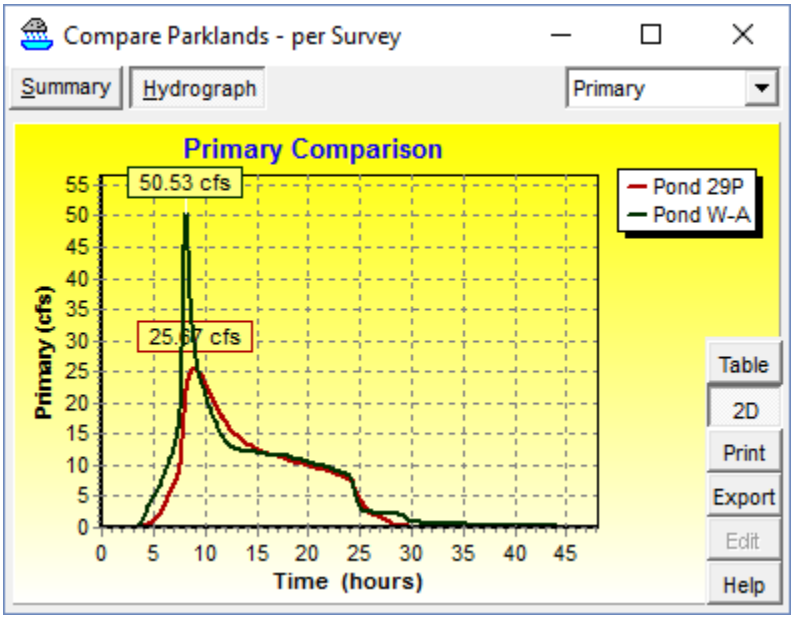
Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.20	1.4	14.2	132	0.31
0.30	3.0	18.5	284	0.91
0.47	8.2	41.9	761	2.76
0.48	8.6	42.8	800	2.95
0.58	13.4	52.4	1,243	5.37
0.65	17.5	66.6	1,630	7.22
0.96	40.0	78.4	3,719	25.53
1.35	79.4	124.1	7,387	59.05

APPENDIX b-2a SUPPORT FILES FOR HYDROPERIOD EVALUATION

5. HCAD Single Event Hydrograph Plot

FIG. 1 COMPARE HISTORIC FLOW AND POST FULL- BUILD FLOW

- 100-yr, 24-hr, single event – Flow at Cross-section at north property line
- No Flow Control per Min. Requirement #7



- Red is Historic and green is Post-Full Build

Even though post flow is nearly twice the historic, it is 'quickly' attenuated and the falling limb soon matches the historic (would also match existing condition).

A rough estimate of the volume during the peak is about 68,000 cu ft in about a 1.75 hour period of time.

The 100-yr,24-hr event Historic volume is 21.126 ac-ft and the Full-Build volume is 24.707 ac-ft or a 17% increase.

Historic:

The maximum velocity at the control section is 0.64 fps and the average for the event is 0.30 fps.

Post Full Build:

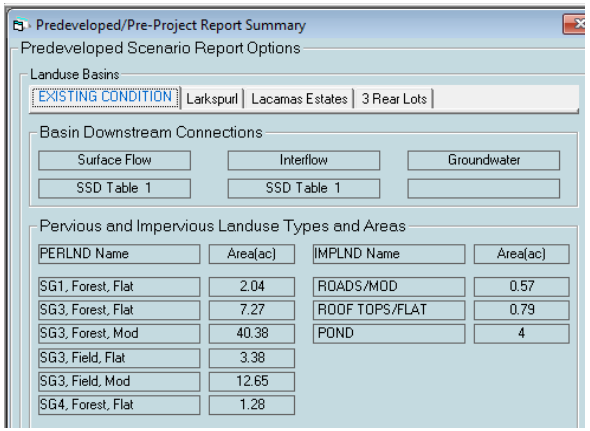
The maximum velocity at the control section is 0.72 fps and the average for the event is 0.36 fps.

- **These are not erosive velocities as the typical erosive velocity would be above 3 fps.**

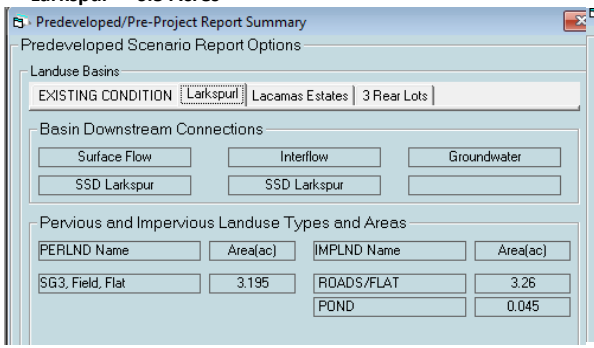
APPENDIX B WETLAND PROTECTION
B-2b MR #8 ANNUAL WLF COMPARISON

WWHM Input Values

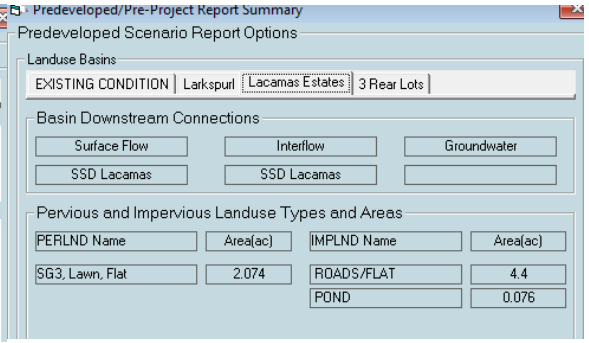
72.36 Acres and add other three areas = 86.13 Acres



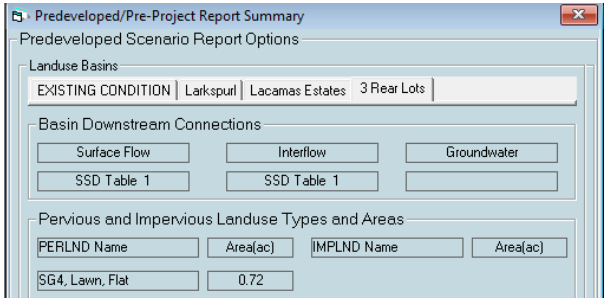
Larkspur = 6.5 Acres



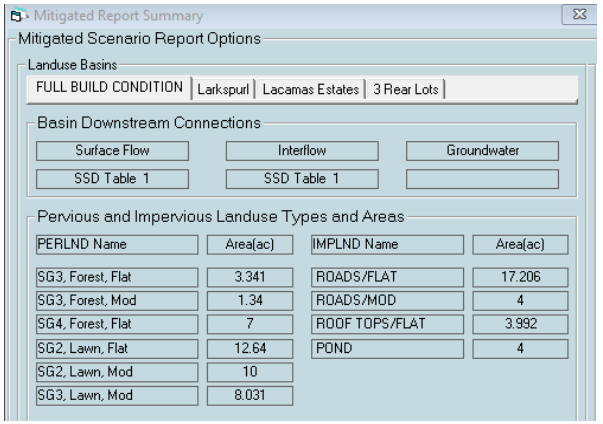
Lacamas Estates = 6.55 Acres



3 Lots = 0.72 Acres - input as HSG D (composite with roofs)

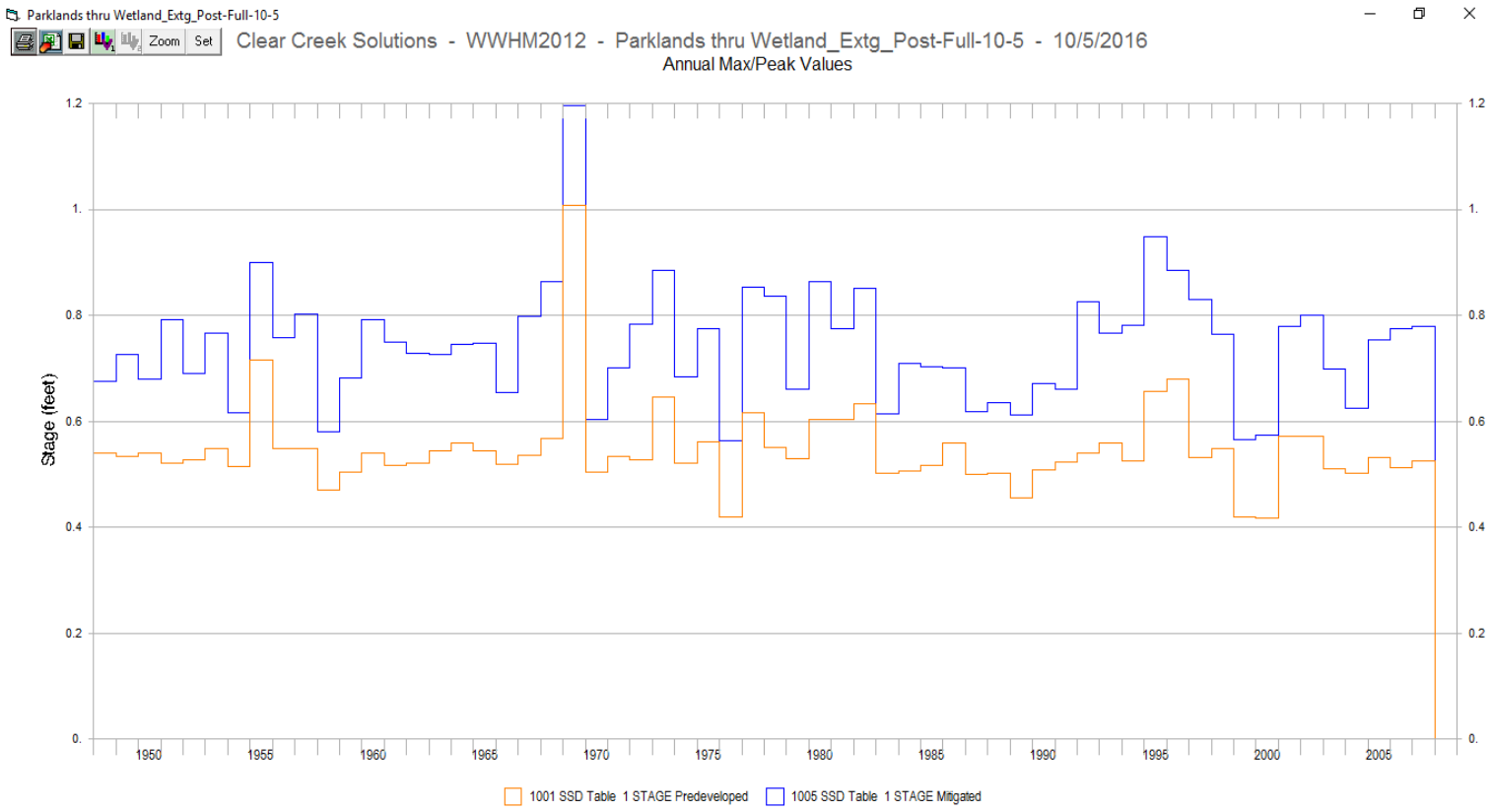


Full Development = 71.55 Acres. The add other three areas 85.32 Acres in model



Notes:
1. Both models apply surface runoff and interflow conditions but not groundwater. Assumed sandstone close to surface at site and to south of site is restrictive.
2. Both models are based on the same SSD Table input and based on the same control section forflow release.
3. Both model apply precipitaion and evaporation to the wetland ponding surface. Actually this area was already accounted for as 4 acres in runoff area summaries. it was
• Since it was applied in the same manner to both, it doesn't skew the revative difference in WLFs.

APPENDIX B WETLAND PROTECTION
B-2b MR #8 ANNUAL WLF COMPARISON



APPENDIX B WETLAND PROTECTION
B-2b MR #8 ANNUAL WLF COMPARISON

Chronologic Order (Part 1)

Yearly Start in October Annual Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
10/1/1948	0.5395406	0.6758	0.136
10/1/1949	0.5338328	0.725099	0.191
10/1/1950	0.5396591	0.679822	0.140
10/1/1951	0.5205137	0.791648	0.271
10/1/1952	0.5279581	0.690198	0.162
10/1/1953	0.5484218	0.76568	0.217
10/1/1954	0.5154371	0.615881	0.100
10/1/1955	0.7146549	0.900133	0.185
10/1/1956	0.5493676	0.757547	0.208
10/1/1957	0.5488995	0.802242	0.253
10/1/1958	0.47091	0.581094	0.110
10/1/1959	0.5047801	0.681179	0.176
10/1/1960	0.5394353	0.791504	0.252
10/1/1961	0.5176865	0.750177	0.232
10/1/1962	0.520259	0.727708	0.207
10/1/1963	0.5450631	0.725677	0.181
10/1/1964	0.5596859	0.744215	0.185
10/1/1965	0.5438498	0.746706	0.203
10/1/1966	0.5186027	0.654297	0.136
10/1/1967	0.5356779	0.798385	0.263
10/1/1968	0.5683826	0.862985	0.295
10/1/1969	1.006669	1.195714	0.189
10/1/1970	0.5031672	0.603265	0.100
10/1/1971	0.5335248	0.700894	0.167
10/1/1972	0.5283074	0.782503	0.254
10/1/1973	0.6455432	0.883976	0.238
10/1/1974	0.5202874	0.684284	0.164
10/1/1975	0.5612866	0.774875	0.214
10/1/1976	0.4195426	0.562605	0.143
10/1/1977	0.6157556	0.853217	0.237
10/1/1978	0.5504337	0.835704	0.285

Chronologic Order (Part 2)

Yearly Start in October Annual Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
10/1/1979	0.530083	0.661415	0.131
10/1/1980	0.602645	0.863093	0.260
10/1/1981	0.603908	0.77411	0.170
10/1/1982	0.633952	0.851683	0.218
10/1/1983	0.502442	0.613586	0.111
10/1/1984	0.506779	0.709827	0.203
10/1/1985	0.516684	0.703085	0.186
10/1/1986	0.5589	0.701622	0.143
10/1/1987	0.500365	0.61721	0.117
10/1/1988	0.501101	0.635145	0.134
10/1/1989	0.454764	0.611058	0.156
10/1/1990	0.507534	0.671266	0.164
10/1/1991	0.52322	0.661414	0.138
10/1/1992	0.53982	0.826355	0.287
10/1/1993	0.559034	0.767289	0.208
10/1/1994	0.524672	0.781118	0.256
10/1/1995	0.656995	0.947417	0.290
10/1/1996	0.679676	0.885464	0.206
10/1/1997	0.53199	0.829502	0.298
10/1/1998	0.549406	0.763878	0.214
10/1/1999	0.418597	0.56493	0.146
10/1/2000	0.418002	0.57303	0.155
10/1/2001	0.571142	0.778123	0.207
10/1/2002	0.57146	0.799171	0.228
10/1/2003	0.509367	0.69792	0.189
10/1/2004	0.501092	0.625087	0.124
10/1/2005	0.532091	0.754634	0.223
10/1/2006	0.512854	0.77507	0.262
10/1/2007	0.525068	0.779752	0.255
10/1/2008	0	0	0.000

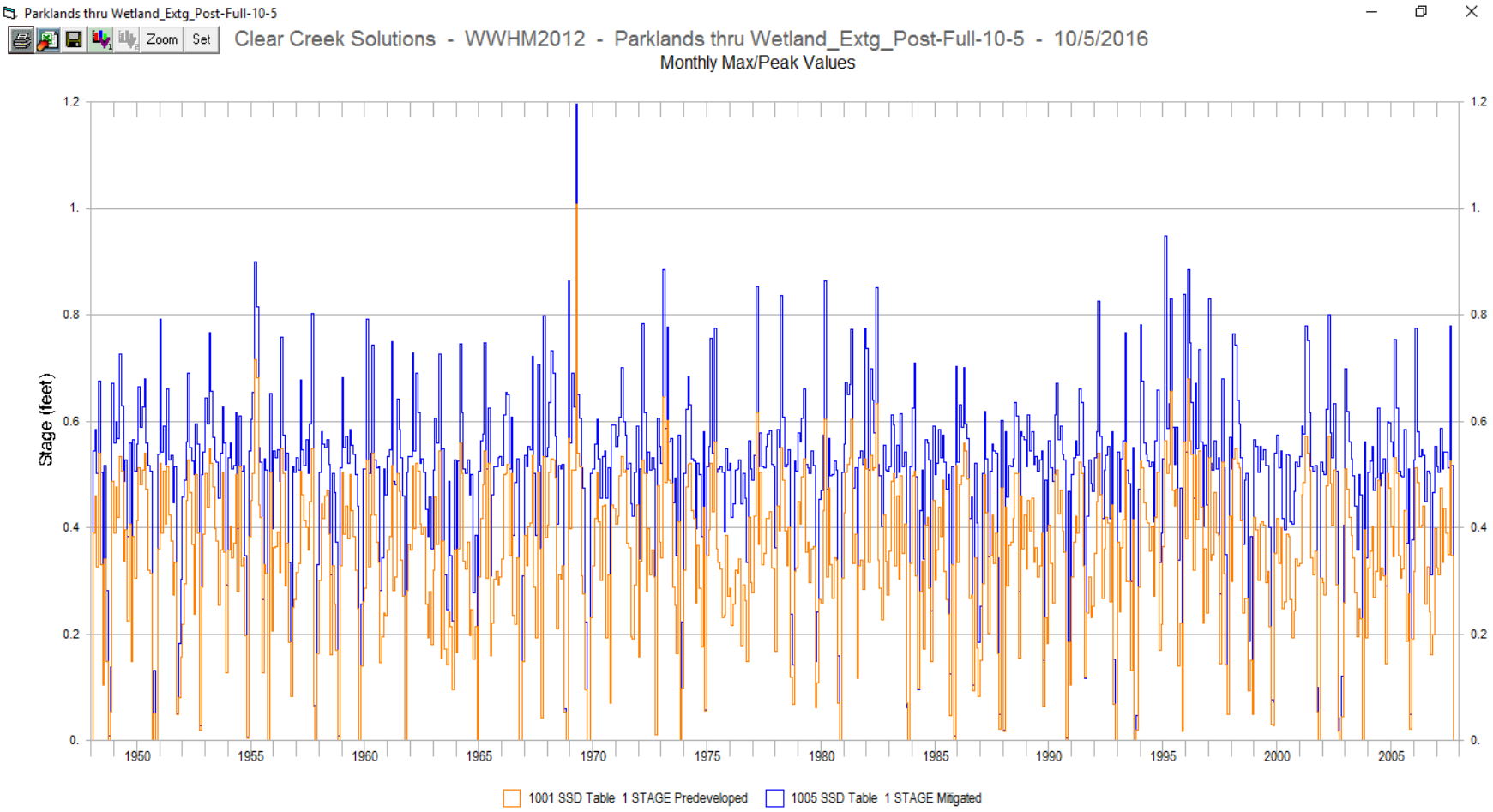
WFL - Highest to Lowest (Part 1)

Yearly Start in October Annual Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
10/1/1997	0.53199	0.829502	0.298
10/1/1968	0.568383	0.862985	0.295
10/1/1995	0.656995	0.947417	0.290
10/1/1992	0.53982	0.826355	0.287
10/1/1978	0.550434	0.835704	0.285
10/1/1951	0.520514	0.791648	0.271
10/1/1967	0.535678	0.798385	0.263
10/1/2006	0.512854	0.77507	0.262
10/1/1980	0.602645	0.863093	0.260
10/1/1994	0.524672	0.781118	0.256
10/1/2007	0.525068	0.779752	0.255
10/1/1972	0.528307	0.782503	0.254
10/1/1957	0.5489	0.802242	0.253
10/1/1960	0.539435	0.791504	0.252
10/1/1973	0.645543	0.883976	0.238
10/1/1977	0.615756	0.853217	0.237
10/1/1961	0.517687	0.750177	0.232
10/1/2002	0.57146	0.799171	0.228
10/1/2005	0.532091	0.754634	0.223
10/1/1982	0.633952	0.851683	0.218
10/1/1953	0.548422	0.76568	0.217
10/1/1998	0.549406	0.763878	0.214
10/1/1975	0.561287	0.774875	0.214
10/1/1993	0.559034	0.767289	0.208
10/1/1956	0.549368	0.757547	0.208
10/1/1962	0.520259	0.727708	0.207
10/1/2001	0.571142	0.778123	0.207
10/1/1996	0.679676	0.885464	0.206
10/1/1984	0.506779	0.709827	0.203
10/1/1965	0.54385	0.746706	0.203
10/1/1949	0.533833	0.725099	0.191

WFL - Highest to Lowest (Part 2)

Yearly Start in October Annual Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
10/1/1969	1.006669	1.195714	0.189
10/1/2003	0.509367	0.69792	0.189
10/1/1985	0.516684	0.703085	0.186
10/1/1955	0.714655	0.900133	0.185
10/1/1964	0.559686	0.744215	0.185
10/1/1963	0.545063	0.725677	0.181
10/1/1959	0.50478	0.681179	0.176
10/1/1981	0.603908	0.77411	0.170
10/1/1971	0.533525	0.700894	0.167
10/1/1974	0.520287	0.684284	0.164
10/1/1990	0.507534	0.671266	0.164
10/1/1952	0.527958	0.690198	0.162
10/1/1989	0.454764	0.611058	0.156
10/1/2000	0.418002	0.57303	0.155
10/1/1999	0.418597	0.56493	0.146
10/1/1976	0.419543	0.562605	0.143
10/1/1986	0.5589	0.701622	0.143
10/1/1950	0.539659	0.679822	0.140
10/1/1991	0.52322	0.661414	0.138
10/1/1948	0.539541	0.6758	0.136
10/1/1966	0.518603	0.654297	0.136
10/1/1988	0.501101	0.635145	0.134
10/1/1979	0.530083	0.661415	0.131
10/1/2004	0.501092	0.625087	0.124
10/1/1987	0.500365	0.61721	0.117
10/1/1983	0.502442	0.613586	0.111
10/1/1958	0.47091	0.581094	0.110
10/1/1954	0.515437	0.615881	0.100
10/1/1970	0.503167	0.603265	0.100
10/1/2008	0	0	0.000

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)



APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

Chronologic Order (Part 1)

Month/Yr Monthly Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
########	0	0	0.000
########	0.3889198	0.543298	0.154
########	0.4606003	0.585275	0.125
1/1/1949	0.3254456	0.501706	0.176
2/1/1949	0.5395406	0.6758	0.136
3/1/1949	0.330761	0.504087	0.173
4/1/1949	0.1031704	0.274826	0.172
5/1/1949	0.3408766	0.517458	0.177
6/1/1949	0.1494969	0.282105	0.133
7/1/1949	0.00045924	0.009925	0.009
8/1/1949	0.05268456	0.138584	0.086
9/1/1949	0.4860552	0.67181	0.186
########	0.3906267	0.559442	0.169
########	0.4756182	0.599147	0.124
########	0.4195786	0.567196	0.148
1/1/1950	0.5338328	0.725099	0.191
2/1/1950	0.5055011	0.628924	0.123
3/1/1950	0.3372491	0.487871	0.151
4/1/1950	0.3958348	0.527487	0.132
5/1/1950	0.224558	0.383682	0.159
6/1/1950	0.4059314	0.558609	0.153
7/1/1950	0.1475885	0.333041	0.185
8/1/1950	0.3826286	0.564423	0.182
9/1/1950	0.3049622	0.505195	0.200
########	0.4125287	0.556421	0.144
########	0.51243	0.664537	0.152
########	0.4802838	0.588201	0.108
1/1/1951	0.5088556	0.627017	0.118
2/1/1951	0.5396591	0.679822	0.140
3/1/1951	0.472095	0.559095	0.087
4/1/1951	0.3198473	0.515922	0.196
5/1/1951	0.3128576	0.505526	0.193
6/1/1951	0.00023113	0.000231	0.000
7/1/1951	0.0503138	0.131306	0.081
8/1/1951	0	0	0.000

Chronologic Order (Part 2)

Month/Yr Monthly Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
########	0.166803	0.362183	0.195
########	0.441239	0.584979	0.144
########	0.39488	0.549545	0.155
1/1/1979	0.550434	0.835704	0.285
2/1/1979	0.488521	0.607168	0.119
3/1/1979	0.394872	0.514431	0.120
4/1/1979	0.327586	0.51943	0.192
5/1/1979	0.400831	0.545511	0.145
6/1/1979	0.119676	0.237475	0.118
7/1/1979	0.067903	0.142752	0.075
8/1/1979	0.318179	0.524283	0.206
9/1/1979	0.323774	0.505163	0.181
########	0.449814	0.577126	0.127
########	0.405746	0.560517	0.155
########	0.494515	0.605085	0.111
1/1/1980	0.530083	0.661415	0.131
2/1/1980	0.354799	0.517937	0.163
3/1/1980	0.373881	0.511603	0.138
4/1/1980	0.29717	0.50102	0.204
5/1/1980	0.360286	0.544243	0.184
6/1/1980	0.363487	0.51674	0.153
7/1/1980	0.060983	0.148867	0.088
8/1/1980	0.108186	0.242158	0.134
9/1/1980	0.264043	0.454237	0.190
########	0.259436	0.470209	0.211
########	0.431197	0.573349	0.142
########	0.602645	0.863093	0.260
1/1/1981	0.306919	0.472511	0.166
2/1/1981	0.47432	0.56693	0.093
3/1/1981	0.330382	0.497999	0.168
4/1/1981	0.266339	0.500202	0.234
5/1/1981	0.342268	0.525553	0.183
6/1/1981	0.338973	0.508084	0.169
7/1/1981	0.070363	0.159847	0.089
8/1/1981	0	0	0.000

WFL - Highest to Lowest (Part 1)

Month/Yr Monthly Basis	1000 SSD Table 1 Stage Existing	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
########	0.563138	0.947417	0.384
########	0.53199	0.829502	0.298
9/1/1969	0.568383	0.862985	0.295
########	0.53982	0.826355	0.287
1/1/1979	0.550434	0.835704	0.285
8/1/1991	0.185368	0.469012	0.284
9/1/1996	0.561034	0.839125	0.278
6/1/1976	0.231176	0.502951	0.272
9/1/1970	0.230611	0.502043	0.271
########	0.520514	0.791648	0.271
8/1/1961	0.240464	0.509617	0.269
8/1/2007	0.199857	0.466889	0.267
4/1/1977	0.17848	0.44532	0.267
5/1/1967	0.219018	0.483982	0.265
########	0.526968	0.791504	0.265
8/1/1968	0.533937	0.798385	0.264
5/1/1965	0.197376	0.461594	0.264
8/1/1957	0.250746	0.514679	0.264
5/1/1986	0.238195	0.500769	0.263
########	0.512854	0.77507	0.262
5/1/1971	0.193056	0.455205	0.262
6/1/2007	0.241062	0.502665	0.262
4/1/1953	0.23747	0.498787	0.261
########	0.602645	0.863093	0.260
8/1/1990	0.231592	0.490059	0.258
########	0.524672	0.781118	0.256
7/1/1996	0.219554	0.474331	0.255
5/1/2008	0.525068	0.779752	0.255
6/1/1965	0.246128	0.500558	0.254
########	0.528307	0.782503	0.254
5/1/2004	0.247051	0.500798	0.254
6/1/1958	0.5489	0.802242	0.253
8/1/1992	0.230806	0.482565	0.252
9/1/1960	0.260047	0.510475	0.250
6/1/1972	0.194785	0.444239	0.249

WFL - Highest to Lowest (Part 2)

Month/Yr Monthly Basis	1000 SSD Table 1 Stage Exsting	1003 SSD Table 1 Stage Post-full	WFL Stage Diff. (ft)
6/1/1978	0.417998	0.575578	0.158
########	0.402059	0.559504	0.157
########	0.437768	0.595015	0.157
########	0.396115	0.552658	0.157
########	0.396876	0.553362	0.156
3/1/1953	0.368135	0.524598	0.156
6/1/1968	0.360376	0.516788	0.156
6/1/1993	0.259979	0.416308	0.156
7/1/1976	0.235702	0.391706	0.156
2/1/2004	0.342844	0.498492	0.156
5/1/1998	0.523073	0.678701	0.156
9/1/1953	0.38668	0.542289	0.156
4/1/1960	0.382963	0.538037	0.155
########	0.418002	0.57303	0.155
7/1/1995	0.503073	0.657916	0.155
2/1/1971	0.300296	0.455104	0.155
########	0.405746	0.560517	0.155
########	0.39488	0.549545	0.155
5/1/1975	0.36599	0.520507	0.155
########	0.38892	0.543298	0.154
9/1/2007	0.398558	0.552779	0.154
3/1/2008	0.388711	0.542767	0.154
4/1/1965	0.373016	0.526946	0.154
########	0.392705	0.546159	0.153
########	0.500958	0.654297	0.153
6/1/1980	0.363487	0.51674	0.153
4/1/2001	0.382573	0.535698	0.153
6/1/1990	0.390205	0.543224	0.153
9/1/1968	0.381087	0.534058	0.153
########	0.451621	0.604413	0.153
6/1/1950	0.405931	0.558609	0.153
########	0.390034	0.542547	0.153
7/1/1978	0.429746	0.582213	0.152
########	0.51243	0.664537	0.152
2/1/1985	0.279276	0.431279	0.152

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

9/1/1951	0.3597596	0.537375	0.178
########	0.5205137	0.791648	0.271
########	0.390034	0.542547	0.153
########	0.5056912	0.591647	0.086
1/1/1952	0.4072077	0.518023	0.111
2/1/1952	0.5138198	0.659805	0.146
3/1/1952	0.4228382	0.528187	0.105
4/1/1952	0.3759083	0.535493	0.160
5/1/1952	0.272432	0.44642	0.174
6/1/1952	0.3345274	0.514334	0.180
7/1/1952	0.0498891	0.050844	0.001
8/1/1952	0.08067256	0.183104	0.102
9/1/1952	0.1573422	0.303738	0.146
########	0.2188435	0.457513	0.239
########	0.2949103	0.489492	0.195
########	0.4503163	0.561079	0.111
1/1/1953	0.5279581	0.690198	0.162
2/1/1953	0.4666425	0.549654	0.083
3/1/1953	0.3681347	0.524598	0.156
4/1/1953	0.2374703	0.498787	0.261
5/1/1953	0.5001945	0.594626	0.094
6/1/1953	0.3895462	0.557334	0.168
7/1/1953	0.0199872	0.02735	0.007
8/1/1953	0.2884206	0.500758	0.212
9/1/1953	0.3866798	0.542289	0.156
########	0.5021553	0.643405	0.141
########	0.4377676	0.595015	0.157
########	0.5484218	0.76568	0.217
1/1/1954	0.521135	0.65598	0.135
2/1/1954	0.4768988	0.569711	0.093
3/1/1954	0.3981145	0.527167	0.129
4/1/1954	0.3744024	0.522489	0.148
5/1/1954	0.2533177	0.454638	0.201
6/1/1954	0.3588542	0.540816	0.182
7/1/1954	0.5040935	0.627581	0.123
8/1/1954	0.3531407	0.559841	0.207
9/1/1954	0.1278746	0.292209	0.164
########	0.3586135	0.531605	0.173
########	0.4020585	0.559504	0.157
########	0.3427964	0.510794	0.168

9/1/1981	0.305862	0.504333	0.198
########	0.427888	0.555822	0.128
########	0.502993	0.673766	0.171
########	0.519025	0.649697	0.131
1/1/1982	0.530537	0.669641	0.139
2/1/1982	0.603908	0.773104	0.169
3/1/1982	0.333464	0.475001	0.142
4/1/1982	0.38781	0.512722	0.125
5/1/1982	0.117833	0.240711	0.123
6/1/1982	0.328429	0.530437	0.202
7/1/1982	0.338312	0.544263	0.206
8/1/1982	0.284137	0.518153	0.234
9/1/1982	0.529147	0.77411	0.245
########	0.511362	0.736522	0.225
########	0.334363	0.508833	0.174
########	0.535897	0.697778	0.162
1/1/1983	0.507311	0.6393	0.132
2/1/1983	0.511905	0.577698	0.066
3/1/1983	0.633952	0.851683	0.218
4/1/1983	0.339766	0.519029	0.179
5/1/1983	0.286185	0.49846	0.212
6/1/1983	0.227498	0.403467	0.176
7/1/1983	0.423036	0.554501	0.131
8/1/1983	0.335909	0.508517	0.173
9/1/1983	0.272339	0.506609	0.234
########	0.35609	0.515401	0.159
########	0.486413	0.61249	0.126
########	0.502442	0.593752	0.091
1/1/1984	0.328511	0.493526	0.165
2/1/1984	0.459677	0.55406	0.094
3/1/1984	0.303145	0.504365	0.201
4/1/1984	0.498471	0.613586	0.115
5/1/1984	0.352255	0.514767	0.163
6/1/1984	0.406791	0.541025	0.134
7/1/1984	0.070569	0.062683	-0.008
8/1/1984	0	0	0.000
9/1/1984	0.332154	0.514455	0.182
########	0.497872	0.623537	0.126
########	0.506779	0.709827	0.203
########	0.310168	0.495458	0.185

9/1/1982	0.529147	0.77411	0.245
6/1/1964	0.241806	0.486152	0.244
8/1/1966	0.291671	0.532153	0.240
5/1/1966	0.220905	0.461161	0.240
7/1/1985	0.287119	0.52645	0.239
9/1/1957	0.265416	0.504585	0.239
########	0.218844	0.457513	0.239
########	0.645543	0.883976	0.238
5/1/1974	0.25445	0.492647	0.238
########	0.615756	0.853217	0.237
9/1/1976	0.271159	0.507367	0.236
7/1/2006	0.275086	0.511151	0.236
8/1/1987	0.17359	0.409293	0.236
########	0.287019	0.521825	0.235
########	0.521224	0.75575	0.235
6/1/1999	0.26754	0.501831	0.234
9/1/1983	0.272339	0.506609	0.234
########	0.529819	0.763878	0.234
8/1/1982	0.284137	0.518153	0.234
4/1/1981	0.266339	0.500202	0.234
8/1/1999	0.151186	0.383915	0.233
########	0.517687	0.750177	0.232
6/1/2004	0.229509	0.460968	0.231
7/1/1972	0.191	0.421284	0.230
########	0.272538	0.500758	0.228
########	0.259068	0.487066	0.228
1/1/2003	0.57146	0.799171	0.228
9/1/1966	0.30654	0.533136	0.227
9/1/1961	0.236344	0.462148	0.226
########	0.511362	0.736522	0.225
########	0.285678	0.510307	0.225
8/1/1962	0.281712	0.504489	0.223
5/1/1999	0.266622	0.489229	0.223
########	0.532091	0.754634	0.223
7/1/2001	0.244773	0.467067	0.222
2/1/1973	0.279645	0.501825	0.222
6/1/2005	0.308598	0.529738	0.221
7/1/1992	0.307709	0.527333	0.220
4/1/2000	0.297484	0.516468	0.219
9/1/2002	0.304964	0.523087	0.218

########	0.479899	0.63145	0.152
5/1/2006	0.432456	0.583916	0.151
6/1/1988	0.389394	0.540693	0.151
4/1/1959	0.161124	0.312298	0.151
########	0.502201	0.653192	0.151
7/1/2007	0.160731	0.311678	0.151
3/1/2001	0.387393	0.538325	0.151
2/1/1993	0.266611	0.417462	0.151
7/1/1955	0.196985	0.347789	0.151
4/1/1987	0.26704	0.417823	0.151
3/1/1950	0.337249	0.487871	0.151
########	0.422029	0.572444	0.150
########	0.402039	0.552364	0.150
1/1/1989	0.365722	0.515969	0.150
########	0.393451	0.543649	0.150
8/1/1971	0.442506	0.59257	0.150
6/1/1957	0.184604	0.334334	0.150
4/1/1966	0.159834	0.309548	0.150
9/1/2004	0.193775	0.343482	0.150
4/1/1967	0.235758	0.3852	0.149
########	0.403231	0.552425	0.149
########	0.4568	0.605991	0.149
9/1/1972	0.441968	0.591106	0.149
1/1/1986	0.382761	0.531428	0.149
########	0.386548	0.53495	0.148
9/1/1998	0.421188	0.569553	0.148
4/1/1954	0.374402	0.522489	0.148
3/1/1993	0.359802	0.507816	0.148
8/1/1956	0.504863	0.652626	0.148
7/1/1961	0.195966	0.343601	0.148
########	0.419579	0.567196	0.148
5/1/1958	0.448316	0.595473	0.147
1/1/1994	0.415236	0.562374	0.147
5/1/2001	0.264024	0.4106	0.147
1/1/1955	0.370708	0.517189	0.146
9/1/1952	0.157342	0.303738	0.146
7/1/2005	0.143566	0.289951	0.146
########	0.404788	0.551149	0.146
########	0.418597	0.56493	0.146
1/1/2000	0.405936	0.552009	0.146

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

1/1/1955	0.3707077	0.517189	0.146
2/1/1955	0.5001177	0.615881	0.116
3/1/1955	0.2803654	0.398497	0.118
4/1/1955	0.5154371	0.610317	0.095
5/1/1955	0.3278739	0.507082	0.179
6/1/1955	0.3433141	0.517679	0.174
7/1/1955	0.1969851	0.347789	0.151
8/1/1955	0.00569801	0.006212	0.001
9/1/1955	0.3830648	0.544102	0.161
########	0.4516213	0.604413	0.153
########	0.5022007	0.653192	0.151
########	0.7146549	0.900133	0.185
1/1/1956	0.6827379	0.815251	0.133
2/1/1956	0.4418734	0.550884	0.109
3/1/1956	0.4185046	0.522275	0.104
4/1/1956	0.1283704	0.263982	0.136
5/1/1956	0.3299178	0.529543	0.200
6/1/1956	0.3145488	0.508795	0.194
7/1/1956	0.00021448	1.68E-05	0.000
8/1/1956	0.5048633	0.652626	0.148
9/1/1956	0.2052681	0.397339	0.192
########	0.3632559	0.543617	0.180
########	0.3635143	0.531416	0.168
########	0.3927048	0.546159	0.153
1/1/1957	0.3161193	0.486254	0.170
2/1/1957	0.5493676	0.757547	0.208
3/1/1957	0.5017435	0.572922	0.071
4/1/1957	0.2911503	0.508914	0.218
5/1/1957	0.3702774	0.539989	0.170
6/1/1957	0.1846044	0.334334	0.150
7/1/1957	0.08236788	0.187128	0.105
8/1/1957	0.2507455	0.514679	0.264
9/1/1957	0.2654164	0.504585	0.239
########	0.3155639	0.532475	0.217
########	0.3336456	0.508054	0.174
########	0.505983	0.678046	0.172
1/1/1958	0.4615452	0.547115	0.086
2/1/1958	0.4119957	0.516356	0.104
3/1/1958	0.4002277	0.565264	0.165
4/1/1958	0.357785	0.502868	0.145

1/1/1985	0.097239	0.095204	-0.002
2/1/1985	0.279276	0.431279	0.152
3/1/1985	0.337694	0.508571	0.171
4/1/1985	0.170901	0.340388	0.169
5/1/1985	0.404237	0.565385	0.161
6/1/1985	0.42027	0.558413	0.138
7/1/1985	0.287119	0.52645	0.239
8/1/1985	0.147923	0.244825	0.097
9/1/1985	0.450956	0.590015	0.139
########	0.300923	0.499036	0.198
########	0.357033	0.520606	0.164
########	0.438626	0.584196	0.146
1/1/1986	0.382761	0.531428	0.149
2/1/1986	0.48883	0.574097	0.085
3/1/1986	0.316883	0.522462	0.206
4/1/1986	0.264349	0.472029	0.208
5/1/1986	0.238195	0.500769	0.263
6/1/1986	0.047449	0.124744	0.077
7/1/1986	0.330599	0.515565	0.185
8/1/1986	0.001417	0.009005	0.008
9/1/1986	0.516684	0.703085	0.186
########	0.334556	0.522102	0.188
########	0.479899	0.63145	0.152
########	0.497743	0.588999	0.091
1/1/1987	0.5589	0.701622	0.143
2/1/1987	0.545164	0.59479	0.050
3/1/1987	0.492109	0.56777	0.076
4/1/1987	0.26704	0.417823	0.151
5/1/1987	0.272686	0.457857	0.185
6/1/1987	0.093248	0.103408	0.010
7/1/1987	0.342427	0.52041	0.178
8/1/1987	0.17359	0.409293	0.236
9/1/1987	0.082511	0.183683	0.101
########	0.150717	0.252756	0.102
########	0.294482	0.502713	0.208
########	0.500365	0.61721	0.117
1/1/1988	0.428761	0.528936	0.100
2/1/1988	0.202348	0.34505	0.143
3/1/1988	0.347806	0.506684	0.159
4/1/1988	0.422778	0.557089	0.134

4/1/1957	0.29115	0.508914	0.218
3/1/1983	0.633952	0.851683	0.218
########	0.548422	0.76568	0.217
########	0.315564	0.532475	0.217
9/1/1992	0.252068	0.467783	0.216
2/1/1976	0.561287	0.774875	0.214
3/1/1968	0.288416	0.501781	0.213
9/1/1977	0.296218	0.509571	0.213
6/1/1975	0.286525	0.499835	0.213
6/1/2001	0.193485	0.406703	0.213
8/1/1972	0.291864	0.505004	0.213
2/1/2002	0.53911	0.752218	0.213
9/1/1990	0.182079	0.394478	0.212
5/1/2003	0.293047	0.505397	0.212
8/1/1953	0.288421	0.500758	0.212
5/1/1983	0.286185	0.49846	0.212
5/1/1988	0.333032	0.544816	0.212
########	0.298129	0.509528	0.211
5/1/1977	0.291476	0.50259	0.211
########	0.278473	0.489449	0.211
########	0.259436	0.470209	0.211
8/1/1989	0.360252	0.571023	0.211
########	0.31781	0.528298	0.210
6/1/1966	0.303588	0.514074	0.210
########	0.296641	0.50699	0.210
########	0.517413	0.727708	0.210
3/1/1994	0.29926	0.508607	0.209
6/1/1959	0.256818	0.465414	0.209
2/1/1994	0.559034	0.767289	0.208
########	0.294482	0.502713	0.208
2/1/1957	0.549368	0.757547	0.208
4/1/1986	0.264349	0.472029	0.208
7/1/1998	0.142244	0.349518	0.207
7/1/1975	0.176719	0.383713	0.207
1/1/2002	0.571142	0.778123	0.207
2/1/1966	0.304224	0.511075	0.207
8/1/1954	0.353141	0.559841	0.207
5/1/1969	0.303122	0.509397	0.206
8/1/1979	0.318179	0.524283	0.206
7/1/1982	0.338312	0.544263	0.206

2/1/1952	0.51382	0.659805	0.146
3/1/1998	0.385441	0.531136	0.146
9/1/2003	0.259288	0.40486	0.146
########	0.438626	0.584196	0.146
1/1/1992	0.390797	0.536309	0.146
########	0.398629	0.544115	0.145
########	0.417145	0.562598	0.145
########	0.47744	0.622801	0.145
4/1/1958	0.357785	0.502868	0.145
1/1/1978	0.368909	0.513806	0.145
5/1/1979	0.400831	0.545511	0.145
########	0.407659	0.552331	0.145
########	0.473067	0.617664	0.145
########	0.399463	0.543649	0.144
3/1/1973	0.39765	0.541825	0.144
1/1/2004	0.385591	0.52967	0.144
3/1/1976	0.360479	0.504425	0.144
########	0.412529	0.556421	0.144
5/1/1993	0.409426	0.553172	0.144
########	0.441239	0.584979	0.144
########	0.477887	0.621612	0.144
5/1/1991	0.393609	0.536791	0.143
6/1/1995	0.419548	0.562638	0.143
8/1/1977	0.419543	0.562605	0.143
1/1/1987	0.5589	0.701622	0.143
2/1/1988	0.202348	0.34505	0.143
########	0.43866	0.581001	0.142
########	0.431197	0.573349	0.142
########	0.42006	0.561842	0.142
########	0.422408	0.563992	0.142
2/1/1989	0.372082	0.513634	0.142
3/1/1982	0.333464	0.475001	0.142
9/1/1989	0.422822	0.564292	0.141
1/1/1960	0.379191	0.520655	0.141
2/1/2007	0.405047	0.546327	0.141
########	0.502155	0.643405	0.141
8/1/1975	0.438304	0.579526	0.141
3/1/2000	0.405483	0.546656	0.141
4/1/1963	0.387767	0.528326	0.141
3/1/1962	0.501403	0.64162	0.140

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

5/1/1958	0.4483157	0.595473	0.147
6/1/1958	0.5488995	0.802242	0.253
7/1/1958	0.06420413	0.066783	0.003
8/1/1958	0	0	0.000
9/1/1958	0.1635196	0.331235	0.168
########	0.3007539	0.504617	0.204
########	0.4448939	0.581094	0.136
########	0.4170913	0.556057	0.139
1/1/1959	0.4602026	0.550168	0.090
2/1/1959	0.47091	0.565815	0.095
3/1/1959	0.3869302	0.517795	0.131
4/1/1959	0.1611241	0.312298	0.151
5/1/1959	0.3281681	0.502046	0.174
6/1/1959	0.2568181	0.465414	0.209
7/1/1959	0.1698624	0.372427	0.203
8/1/1959	0.00107722	0.008022	0.007
9/1/1959	0.3278721	0.513048	0.185
########	0.5047801	0.681179	0.176
########	0.3880038	0.550107	0.162
########	0.4412169	0.571395	0.130
1/1/1960	0.3791908	0.520655	0.141
2/1/1960	0.5003392	0.584431	0.084
3/1/1960	0.4323756	0.553908	0.122
4/1/1960	0.3829628	0.538037	0.155
5/1/1960	0.3209791	0.500669	0.180
6/1/1960	0.2484951	0.439901	0.191
7/1/1960	0	0	0.000
8/1/1960	0.1399809	0.256648	0.117
9/1/1960	0.2600469	0.510475	0.250
########	0.2856778	0.510307	0.225
########	0.526968	0.791504	0.265
########	0.3260732	0.500857	0.175
1/1/1961	0.4228096	0.539141	0.116
2/1/1961	0.5394353	0.743453	0.204
3/1/1961	0.4234891	0.527512	0.104
4/1/1961	0.3738431	0.512951	0.139
5/1/1961	0.3355848	0.515144	0.180
6/1/1961	0.1454726	0.281598	0.136
7/1/1961	0.1959661	0.343601	0.148
8/1/1961	0.2404642	0.509617	0.269

5/1/1988	0.333032	0.544816	0.212
6/1/1988	0.389394	0.540693	0.151
7/1/1988	0.162661	0.342274	0.180
8/1/1988	0.020797	0.048901	0.028
9/1/1988	0.473801	0.600887	0.127
########	0.017542	0.019137	0.002
########	0.43866	0.581001	0.142
########	0.290827	0.457412	0.167
1/1/1989	0.365722	0.515969	0.150
2/1/1989	0.372082	0.513634	0.142
3/1/1989	0.41762	0.528829	0.111
4/1/1989	0.501101	0.635145	0.134
5/1/1989	0.500993	0.609325	0.108
6/1/1989	0.15593	0.280598	0.125
7/1/1989	0.459371	0.580591	0.121
8/1/1989	0.360252	0.571023	0.211
9/1/1989	0.422822	0.564292	0.141
########	0.321935	0.51405	0.192
########	0.452008	0.611058	0.159
########	0.393451	0.543649	0.150
1/1/1990	0.454764	0.580884	0.126
2/1/1990	0.335091	0.519552	0.184
3/1/1990	0.362046	0.534111	0.172
4/1/1990	0.307866	0.506969	0.199
5/1/1990	0.327621	0.527623	0.200
6/1/1990	0.390205	0.543224	0.153
7/1/1990	0.063467	0.151279	0.088
8/1/1990	0.231592	0.490059	0.258
9/1/1990	0.182079	0.394478	0.212
########	0.403799	0.563731	0.160
########	0.332825	0.512168	0.179
########	0.259068	0.487066	0.228
1/1/1991	0.500035	0.611202	0.111
2/1/1991	0.507534	0.671266	0.164
3/1/1991	0.424997	0.564637	0.140
4/1/1991	0.469617	0.590639	0.121
5/1/1991	0.393609	0.536791	0.143
6/1/1991	0.352999	0.528091	0.175
7/1/1991	2.61E-06	0.0044	0.004
8/1/1991	0.185368	0.469012	0.284

########	0.679676	0.885464	0.206
4/1/1969	0.311205	0.516916	0.206
3/1/1986	0.316883	0.522462	0.206
1/1/1962	0.282559	0.487539	0.205
9/1/1997	0.238523	0.442856	0.204
2/1/1961	0.539435	0.743453	0.204
########	0.300754	0.504617	0.204
4/1/1980	0.29717	0.50102	0.204
########	0.215408	0.419241	0.204
4/1/1970	0.309311	0.513118	0.204
########	0.506779	0.709827	0.203
1/1/1966	0.54385	0.746706	0.203
########	0.530124	0.732773	0.203
7/1/1959	0.169862	0.372427	0.203
########	0.30173	0.504217	0.202
6/1/1973	0.307867	0.510115	0.202
6/1/1982	0.328429	0.530437	0.202
5/1/1954	0.253318	0.454638	0.201
3/1/1984	0.303145	0.504365	0.201
5/1/1968	0.505036	0.706194	0.201
6/1/1971	0.310901	0.51195	0.201
########	0.332637	0.533281	0.201
6/1/1998	0.312774	0.513288	0.201
9/1/1950	0.304962	0.505195	0.200
5/1/1990	0.327621	0.527623	0.200
1/1/2005	0.269248	0.469234	0.200
5/1/1956	0.329918	0.529543	0.200
4/1/1990	0.307866	0.506969	0.199
########	0.30794	0.506924	0.199
5/1/1970	0.274632	0.473607	0.199
6/1/1996	0.140088	0.338916	0.199
9/1/1981	0.305862	0.504333	0.198
########	0.300923	0.499036	0.198
5/1/2000	0.318442	0.516315	0.198
7/1/1966	0.317647	0.514369	0.197
3/1/1969	0.210636	0.40691	0.196
4/1/1951	0.319847	0.515922	0.196
4/1/1973	0.311685	0.507688	0.196
8/1/1978	0.323662	0.519624	0.196
########	0.166803	0.362183	0.195

2/1/1951	0.539659	0.679822	0.140
3/1/1991	0.424997	0.564637	0.140
########	0.41666	0.556245	0.140
5/1/1995	0.271936	0.411185	0.139
4/1/1961	0.373843	0.512951	0.139
1/1/1982	0.530537	0.669641	0.139
9/1/1985	0.450956	0.590015	0.139
4/1/1964	0.17166	0.310658	0.139
4/1/1975	0.258413	0.397411	0.139
1/1/1968	0.407897	0.546873	0.139
########	0.417091	0.556057	0.139
4/1/1972	0.371057	0.509676	0.139
2/1/1992	0.52322	0.661414	0.138
6/1/1985	0.42027	0.558413	0.138
3/1/1980	0.373881	0.511603	0.138
7/1/1993	0.443121	0.57996	0.137
3/1/2005	0.488324	0.625087	0.137
6/1/1994	0.414539	0.550908	0.136
2/1/1949	0.539541	0.6758	0.136
########	0.444894	0.581094	0.136
6/1/1961	0.145473	0.281598	0.136
3/1/1997	0.53503	0.670963	0.136
2/1/2001	0.260038	0.395708	0.136
4/1/1956	0.12837	0.263982	0.136
1/1/1954	0.521135	0.65598	0.135
2/1/1997	0.320161	0.454974	0.135
5/1/1978	0.417982	0.552474	0.134
4/1/1988	0.422778	0.557089	0.134
6/1/1984	0.406791	0.541025	0.134
1/1/2007	0.400413	0.534463	0.134
4/1/1989	0.501101	0.635145	0.134
8/1/1980	0.108186	0.242158	0.134
4/1/1997	0.41549	0.549213	0.134
3/1/1992	0.502284	0.634985	0.133
6/1/1949	0.149497	0.282105	0.133
########	0.503128	0.635656	0.133
1/1/1956	0.682738	0.815251	0.133
1/1/1983	0.507311	0.6393	0.132
4/1/1998	0.143574	0.275369	0.132
4/1/1950	0.395835	0.527487	0.132

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

9/1/1961	0.2363438	0.462148	0.226
########	0.3589633	0.532604	0.174
########	0.3833846	0.545252	0.162
########	0.5176865	0.750177	0.232
1/1/1962	0.2825586	0.487539	0.205
2/1/1962	0.3064744	0.481429	0.175
3/1/1962	0.5014033	0.64162	0.140
4/1/1962	0.4682464	0.584347	0.116
5/1/1962	0.3394983	0.532296	0.193
6/1/1962	0.2716797	0.459218	0.188
7/1/1962	0	0	0.000
8/1/1962	0.2817124	0.504489	0.223
9/1/1962	0.3694544	0.534595	0.165
########	0.3588333	0.532631	0.174
########	0.5174126	0.727708	0.210
########	0.398629	0.544115	0.145
1/1/1963	0.520259	0.689718	0.169
2/1/1963	0.5063238	0.615288	0.109
3/1/1963	0.4072756	0.520571	0.113
4/1/1963	0.3877669	0.528326	0.141
5/1/1963	0.4012063	0.503848	0.103
6/1/1963	0.2566267	0.434282	0.178
7/1/1963	0.1940033	0.383681	0.190
8/1/1963	0.2800491	0.457018	0.177
9/1/1963	0.1803878	0.361074	0.181
########	0.320277	0.507614	0.187
########	0.4567997	0.605991	0.149
########	0.368816	0.559763	0.191
1/1/1964	0.5450631	0.725677	0.181
2/1/1964	0.1538684	0.345099	0.191
3/1/1964	0.375635	0.549163	0.174
4/1/1964	0.1716604	0.310658	0.139
5/1/1964	0.1431328	0.245747	0.103
6/1/1964	0.2418061	0.486152	0.244
7/1/1964	0.214811	0.346414	0.132
8/1/1964	0.09648819	0.225636	0.129
9/1/1964	0.357805	0.52765	0.170
########	0.165463	0.33267	0.167
########	0.3591588	0.525124	0.166
########	0.5596859	0.744215	0.185

9/1/1991	0.103445	0.141577	0.038
########	0.306862	0.500758	0.194
########	0.373453	0.532443	0.159
########	0.422408	0.563992	0.142
1/1/1992	0.390797	0.536309	0.146
2/1/1992	0.52322	0.661414	0.138
3/1/1992	0.502284	0.634985	0.133
4/1/1992	0.328308	0.51453	0.186
5/1/1992	0.118637	0.11751	-0.001
6/1/1992	0.239019	0.422357	0.183
7/1/1992	0.307709	0.527333	0.220
8/1/1992	0.230806	0.482565	0.252
9/1/1992	0.252068	0.467783	0.216
########	0.350694	0.53125	0.181
########	0.448449	0.57941	0.131
########	0.53982	0.826355	0.287
1/1/1993	0.461626	0.571135	0.110
2/1/1993	0.266611	0.417462	0.151
3/1/1993	0.359802	0.507816	0.148
4/1/1993	0.420272	0.535622	0.115
5/1/1993	0.409426	0.553172	0.144
6/1/1993	0.259979	0.416308	0.156
7/1/1993	0.443121	0.57996	0.137
8/1/1993	0.068489	0.152957	0.084
9/1/1993	4.41E-07	4.37E-07	0.000
########	0.372704	0.543108	0.170
########	0.242403	0.430383	0.188
########	0.361555	0.530241	0.169
1/1/1994	0.415236	0.562374	0.147
2/1/1994	0.559034	0.767289	0.208
3/1/1994	0.29926	0.508607	0.209
4/1/1994	0.298748	0.48197	0.183
5/1/1994	0.130606	0.297901	0.167
6/1/1994	0.414539	0.550908	0.136
7/1/1994	0	0	0.000
8/1/1994	0.019013	0.046788	0.028
9/1/1994	0.287636	0.473173	0.186
########	0.524672	0.781118	0.256
########	0.512107	0.675697	0.164
########	0.446604	0.558499	0.112

2/1/1977	0.314612	0.509467	0.195
8/1/1997	0.360771	0.555445	0.195
########	0.29491	0.489492	0.195
6/1/1956	0.314549	0.508795	0.194
########	0.549406	0.74361	0.194
########	0.306862	0.500758	0.194
3/1/2006	0.304348	0.498117	0.194
5/1/2002	0.311587	0.505279	0.194
6/1/1977	0.261891	0.455098	0.193
5/1/1962	0.339498	0.532296	0.193
5/1/1951	0.312858	0.505526	0.193
4/1/2007	0.257287	0.449583	0.192
########	0.321935	0.51405	0.192
9/1/1956	0.205268	0.397339	0.192
4/1/1979	0.327586	0.51943	0.192
4/1/1968	0.193072	0.384885	0.192
########	0.311565	0.503283	0.192
6/1/1960	0.248495	0.439901	0.191
9/1/1978	0.322374	0.51369	0.191
1/1/1950	0.533833	0.725099	0.191
2/1/1964	0.153868	0.345099	0.191
5/1/1976	0.322445	0.513645	0.191
6/1/1969	0.327844	0.519025	0.191
########	0.368816	0.559763	0.191
########	0.324908	0.515609	0.191
9/1/1980	0.264043	0.454237	0.190
5/1/1997	0.543405	0.733569	0.190
7/1/1963	0.194003	0.383681	0.190
1/1/1970	1.006669	1.195714	0.189
########	0.345352	0.534362	0.189
########	0.509367	0.69792	0.189
########	0.242403	0.430383	0.188
1/1/1977	0.319862	0.507573	0.188
########	0.334556	0.522102	0.188
6/1/1962	0.27168	0.459218	0.188
########	0.320277	0.507614	0.187
7/1/1977	0.148077	0.335409	0.187
9/1/2001	0.328591	0.515399	0.187
9/1/2000	0.352347	0.53913	0.187
########	0.257393	0.444037	0.187

7/1/1964	0.214811	0.346414	0.132
7/1/1983	0.423036	0.554501	0.131
1/1/1980	0.530083	0.661415	0.131
########	0.448449	0.57941	0.131
3/1/1959	0.38693	0.517795	0.131
1/1/1967	0.518603	0.649328	0.131
########	0.519025	0.649697	0.131
########	0.441217	0.571395	0.130
########	0.461883	0.59156	0.130
4/1/1999	0.239412	0.368705	0.129
8/1/1964	0.096488	0.225636	0.129
3/1/1954	0.398115	0.527167	0.129
########	0.427888	0.555822	0.128
3/1/2003	0.403544	0.531216	0.128
########	0.449814	0.577126	0.127
9/1/1988	0.473801	0.600887	0.127
8/1/1973	0.479345	0.606023	0.127
6/1/1970	0.096188	0.22231	0.126
1/1/1990	0.454764	0.580884	0.126
########	0.486413	0.61249	0.126
7/1/1965	0.152636	0.27842	0.126
########	0.497872	0.623537	0.126
4/1/1982	0.38781	0.512722	0.125
########	0.4606	0.585275	0.125
6/1/1989	0.15593	0.280598	0.125
4/1/2003	0.507747	0.632071	0.124
9/1/1974	0.097437	0.221584	0.124
1/1/1995	0.414117	0.538089	0.124
########	0.475618	0.599147	0.124
7/1/1954	0.504094	0.627581	0.123
6/1/1997	0.437609	0.561062	0.123
2/1/1950	0.505501	0.628924	0.123
5/1/1982	0.117833	0.240711	0.123
9/1/2005	0.474815	0.596484	0.122
3/1/1960	0.432376	0.553908	0.122
1/1/2006	0.502693	0.624	0.121
7/1/1989	0.459371	0.580591	0.121
4/1/1991	0.469617	0.590639	0.121
4/1/1995	0.402599	0.523205	0.121
2/1/1998	0.390756	0.511113	0.120

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

1/1/1965	0.5017329	0.615102	0.113
2/1/1965	0.337066	0.511117	0.174
3/1/1965	0.3224925	0.501214	0.179
4/1/1965	0.3730156	0.526946	0.154
5/1/1965	0.1973757	0.461594	0.264
6/1/1965	0.2461276	0.500558	0.254
7/1/1965	0.1526357	0.27842	0.126
8/1/1965	0.2151665	0.384719	0.170
9/1/1965	6.1984E-08	6.2E-08	0.000
########	0.3079403	0.506924	0.199
########	0.4171445	0.562598	0.145
########	0.4813267	0.575313	0.094
1/1/1966	0.5438498	0.746706	0.203
2/1/1966	0.3042236	0.511075	0.207
3/1/1966	0.5199056	0.625046	0.105
4/1/1966	0.1598341	0.309548	0.150
5/1/1966	0.2209045	0.461161	0.240
6/1/1966	0.3035882	0.514074	0.210
7/1/1966	0.3176472	0.514369	0.197
8/1/1966	0.291671	0.532153	0.240
9/1/1966	0.3065397	0.533136	0.227
########	0.3403167	0.515792	0.175
########	0.5000244	0.612847	0.113
########	0.5009583	0.654297	0.153
1/1/1967	0.5186027	0.649328	0.131
2/1/1967	0.3468609	0.509326	0.162
3/1/1967	0.5012392	0.607795	0.107
4/1/1967	0.2357583	0.3852	0.149
5/1/1967	0.2190176	0.483982	0.265
6/1/1967	0.3436111	0.530022	0.186
7/1/1967	2.1718E-06	2.19E-06	0.000
8/1/1967	0	0	0.000
9/1/1967	0.1493572	0.308521	0.159
########	0.3865481	0.53495	0.148
########	0.3281421	0.514267	0.186
########	0.4020385	0.552364	0.150
1/1/1968	0.4078966	0.546873	0.139
2/1/1968	0.5356779	0.72112	0.185
3/1/1968	0.2884161	0.501781	0.213
4/1/1968	0.1930715	0.384885	0.192

1/1/1995	0.414117	0.538089	0.124
2/1/1995	0.409772	0.526091	0.116
3/1/1995	0.355976	0.514696	0.159
4/1/1995	0.402599	0.523205	0.121
5/1/1995	0.271936	0.411185	0.139
6/1/1995	0.419548	0.562638	0.143
7/1/1995	0.503073	0.657916	0.155
8/1/1995	0.170427	0.335087	0.165
9/1/1995	0.218729	0.389618	0.171
########	0.363573	0.528774	0.165
########	0.563138	0.947417	0.384
########	0.500954	0.586585	0.086
1/1/1996	0.519759	0.632093	0.112
2/1/1996	0.656995	0.830074	0.173
3/1/1996	0.469523	0.588615	0.119
4/1/1996	0.4413	0.518348	0.077
5/1/1996	0.472681	0.588193	0.116
6/1/1996	0.140088	0.338916	0.199
7/1/1996	0.219554	0.474331	0.255
8/1/1996	0.018091	0.042174	0.024
9/1/1996	0.561034	0.839125	0.278
########	0.379743	0.542514	0.163
########	0.679676	0.885464	0.206
########	0.562927	0.747193	0.184
1/1/1997	0.538162	0.634113	0.096
2/1/1997	0.320161	0.454974	0.135
3/1/1997	0.53503	0.670963	0.136
4/1/1997	0.41549	0.549213	0.134
5/1/1997	0.543405	0.733569	0.190
6/1/1997	0.437609	0.561062	0.123
7/1/1997	0.220923	0.402526	0.182
8/1/1997	0.360771	0.555445	0.195
9/1/1997	0.238523	0.442856	0.204
########	0.53199	0.829502	0.298
########	0.338046	0.521592	0.184
########	0.35045	0.508684	0.158
1/1/1998	0.465125	0.56255	0.097
2/1/1998	0.390756	0.511113	0.120
3/1/1998	0.385441	0.531136	0.146
4/1/1998	0.143574	0.275369	0.132

6/1/1967	0.343611	0.530022	0.186
9/1/1986	0.516684	0.703085	0.186
3/1/1977	0.341737	0.528111	0.186
4/1/1992	0.328308	0.51453	0.186
########	0.328142	0.514267	0.186
6/1/2000	0.21482	0.400765	0.186
9/1/1949	0.486055	0.67181	0.186
9/1/1994	0.287636	0.473173	0.186
########	0.714655	0.900133	0.185
7/1/1950	0.147589	0.333041	0.185
2/1/1968	0.535678	0.72112	0.185
########	0.310168	0.495458	0.185
9/1/1959	0.327872	0.513048	0.185
5/1/1987	0.272686	0.457857	0.185
7/1/1986	0.330599	0.515565	0.185
9/1/2006	0.191262	0.376084	0.185
########	0.559686	0.744215	0.185
2/1/1990	0.335091	0.519552	0.184
########	0.562927	0.747193	0.184
5/1/1980	0.360286	0.544243	0.184
6/1/1974	0.162857	0.346671	0.184
########	0.157664	0.341408	0.184
########	0.338046	0.521592	0.184
6/1/1992	0.239019	0.422357	0.183
########	0.327755	0.51106	0.183
5/1/1981	0.342268	0.525553	0.183
4/1/1994	0.298748	0.48197	0.183
3/1/1978	0.331128	0.513991	0.183
9/1/1984	0.332154	0.514455	0.182
########	0.507209	0.689443	0.182
6/1/2006	0.187633	0.369792	0.182
########	0.319186	0.501204	0.182
6/1/1954	0.358854	0.540816	0.182
8/1/1950	0.382629	0.564423	0.182
7/1/1997	0.220923	0.402526	0.182
9/1/1973	0.37179	0.553361	0.182
9/1/1979	0.323774	0.505163	0.181
9/1/1963	0.180388	0.361074	0.181
1/1/1964	0.545063	0.725677	0.181
########	0.350694	0.53125	0.181

3/1/1979	0.394872	0.514431	0.120
3/1/1996	0.469523	0.588615	0.119
2/1/1979	0.488521	0.607168	0.119
########	0.508976	0.627359	0.118
3/1/1999	0.412322	0.530494	0.118
1/1/1951	0.508856	0.627017	0.118
3/1/1955	0.280365	0.398497	0.118
6/1/1979	0.119676	0.237475	0.118
########	0.500365	0.61721	0.117
1/1/1999	0.521927	0.638771	0.117
1/1/1971	0.411644	0.528485	0.117
8/1/1960	0.139981	0.256648	0.117
2/1/2000	0.411606	0.528126	0.117
1/1/1961	0.42281	0.539141	0.116
2/1/1995	0.409772	0.526091	0.116
4/1/1962	0.468246	0.584347	0.116
2/1/1955	0.500118	0.615881	0.116
1/1/1973	0.501084	0.61667	0.116
5/1/1996	0.472681	0.588193	0.116
4/1/1993	0.420272	0.535622	0.115
4/1/1984	0.498471	0.613586	0.115
########	0.421142	0.535618	0.114
1/1/1965	0.501733	0.615102	0.113
3/1/1963	0.407276	0.520571	0.113
########	0.500024	0.612847	0.113
1/1/1996	0.519759	0.632093	0.112
########	0.475063	0.587082	0.112
########	0.446604	0.558499	0.112
3/1/1989	0.41762	0.528829	0.111
1/1/1991	0.500035	0.611202	0.111
1/1/1975	0.520287	0.631448	0.111
1/1/1952	0.407208	0.518023	0.111
########	0.450316	0.561079	0.111
########	0.494515	0.605085	0.111
1/1/1976	0.430649	0.540963	0.110
2/1/1970	0.539046	0.649278	0.110
########	0.498454	0.608416	0.110
1/1/1993	0.461626	0.571135	0.110
2/1/1956	0.441873	0.550884	0.109
2/1/1963	0.506324	0.615288	0.109

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

5/1/1968	0.5050358	0.706194	0.201
6/1/1968	0.3603759	0.516788	0.156
7/1/1968	0.04228926	0.043232	0.001
8/1/1968	0.5339366	0.798385	0.264
9/1/1968	0.3810868	0.534058	0.153
########	0.4047884	0.551149	0.146
########	0.5031281	0.635656	0.133
########	0.5301238	0.732773	0.203
1/1/1969	0.5275877	0.690567	0.163
2/1/1969	0.4937429	0.572258	0.079
3/1/1969	0.2106355	0.40691	0.196
4/1/1969	0.3112054	0.516916	0.206
5/1/1969	0.3031215	0.509397	0.206
6/1/1969	0.3278443	0.519025	0.191
7/1/1969	0.05262675	0.058867	0.006
8/1/1969	0	0	0.000
9/1/1969	0.5683826	0.862985	0.295
########	0.3985417	0.55809	0.160
########	0.5072087	0.689443	0.182
########	0.5089761	0.627359	0.118
1/1/1970	1.006669	1.195714	0.189
2/1/1970	0.5390461	0.649278	0.110
3/1/1970	0.5148591	0.605849	0.091
4/1/1970	0.3093105	0.513118	0.204
5/1/1970	0.2746316	0.473607	0.199
6/1/1970	0.09618833	0.22231	0.126
7/1/1970	1.9731E-05	0.000499	0.000
8/1/1970	0	0	0.000
9/1/1970	0.2306105	0.502043	0.271
########	0.3277546	0.51106	0.183
########	0.4166598	0.556245	0.140
########	0.5031672	0.603265	0.100
1/1/1971	0.4116441	0.528485	0.117
2/1/1971	0.3002957	0.455104	0.155
3/1/1971	0.440459	0.532695	0.092
4/1/1971	0.4429955	0.543836	0.101
5/1/1971	0.1930556	0.455205	0.262
6/1/1971	0.3109006	0.51195	0.201
7/1/1971	0.07048396	0.165127	0.095
8/1/1971	0.4425063	0.59257	0.150

5/1/1998	0.523073	0.678701	0.156
6/1/1998	0.312774	0.513288	0.201
7/1/1998	0.142244	0.349518	0.207
8/1/1998	0.048728	0.049873	0.001
9/1/1998	0.421188	0.569553	0.148
########	0.298129	0.509528	0.211
########	0.529819	0.763878	0.234
########	0.549406	0.74361	0.194
1/1/1999	0.521927	0.638771	0.117
2/1/1999	0.512674	0.595341	0.083
3/1/1999	0.412322	0.530494	0.118
4/1/1999	0.239412	0.368705	0.129
5/1/1999	0.266622	0.489229	0.223
6/1/1999	0.26754	0.501831	0.234
7/1/1999	0.093235	0.185681	0.092
8/1/1999	0.151186	0.383915	0.233
9/1/1999	0.04997	0.064105	0.014
########	0.418597	0.56493	0.146
########	0.396115	0.552658	0.157
########	0.30173	0.504217	0.202
1/1/2000	0.405936	0.552009	0.146
2/1/2000	0.411606	0.528126	0.117
3/1/2000	0.405483	0.546656	0.141
4/1/2000	0.297484	0.516468	0.219
5/1/2000	0.318442	0.516315	0.198
6/1/2000	0.21482	0.400765	0.186
7/1/2000	0.029606	0.0756	0.046
8/1/2000	0.028403	0.071657	0.043
9/1/2000	0.352347	0.53913	0.187
########	0.418002	0.57303	0.155
########	0.331853	0.511468	0.180
########	0.399463	0.543649	0.144
1/1/2001	0.248988	0.418176	0.169
2/1/2001	0.260038	0.395708	0.136
3/1/2001	0.387393	0.538325	0.151
4/1/2001	0.382573	0.535698	0.153
5/1/2001	0.264024	0.4106	0.147
6/1/2001	0.193485	0.406703	0.213
7/1/2001	0.244773	0.467067	0.222
8/1/2001	0.341924	0.522128	0.180

5/1/2007	0.325527	0.505925	0.180
########	0.363256	0.543617	0.180
8/1/2001	0.341924	0.522128	0.180
6/1/1952	0.334527	0.514334	0.180
5/1/1960	0.320979	0.500669	0.180
########	0.331853	0.511468	0.180
7/1/1988	0.162661	0.342274	0.180
5/1/1961	0.335585	0.515144	0.180
########	0.324339	0.5037	0.179
########	0.332825	0.512168	0.179
4/1/1983	0.339766	0.519029	0.179
5/1/1955	0.327874	0.507082	0.179
3/1/1965	0.322493	0.501214	0.179
4/1/2005	0.299881	0.478075	0.178
########	0.343392	0.521561	0.178
5/1/2005	0.323526	0.501618	0.178
7/1/1987	0.342427	0.52041	0.178
6/1/1963	0.256627	0.434282	0.178
9/1/1951	0.35976	0.537375	0.178
1/1/2008	0.333796	0.511191	0.177
8/1/1963	0.280049	0.457018	0.177
5/1/1949	0.340877	0.517458	0.177
4/1/1976	0.334824	0.511348	0.177
########	0.50478	0.681179	0.176
1/1/1949	0.325446	0.501706	0.176
6/1/1983	0.227498	0.403467	0.176
########	0.340317	0.515792	0.175
6/1/1991	0.352999	0.528091	0.175
1/1/1974	0.601967	0.77698	0.175
2/1/1962	0.306474	0.481429	0.175
########	0.326073	0.500857	0.175
2/1/2005	0.318036	0.492511	0.174
########	0.334363	0.508833	0.174
########	0.333646	0.508054	0.174
6/1/1955	0.343314	0.517679	0.174
4/1/2006	0.321213	0.495557	0.174
2/1/1965	0.337066	0.511117	0.174
5/1/1952	0.272432	0.44642	0.174
5/1/1959	0.328168	0.502046	0.174
########	0.358833	0.532631	0.174

5/1/1989	0.500993	0.609325	0.108
########	0.480284	0.588201	0.108
3/1/1975	0.417621	0.525491	0.108
3/1/2002	0.507754	0.615246	0.107
3/1/1967	0.501239	0.607795	0.107
3/1/1952	0.422838	0.528187	0.105
3/1/1966	0.519906	0.625046	0.105
7/1/1957	0.082368	0.187128	0.105
2/1/1958	0.411996	0.516356	0.104
3/1/1961	0.423489	0.527512	0.104
3/1/1956	0.418505	0.522275	0.104
2/1/2008	0.437292	0.541061	0.104
5/1/1963	0.401206	0.503848	0.103
5/1/1964	0.143133	0.245747	0.103
8/1/1952	0.080673	0.183104	0.102
########	0.150717	0.252756	0.102
########	0.484316	0.586186	0.102
9/1/1987	0.082511	0.183683	0.101
4/1/1971	0.442996	0.543836	0.101
1/1/1988	0.428761	0.528936	0.100
########	0.503167	0.603265	0.100
8/1/2005	0.501092	0.599224	0.098
2/1/1975	0.431062	0.529011	0.098
1/1/1998	0.465125	0.56255	0.097
8/1/1985	0.147923	0.244825	0.097
2/1/2003	0.482379	0.578831	0.096
1/1/1997	0.538162	0.634113	0.096
3/1/2007	0.440535	0.535748	0.095
2/1/1959	0.47091	0.565815	0.095
4/1/1955	0.515437	0.610317	0.095
########	0.485552	0.580298	0.095
7/1/1971	0.070484	0.165127	0.095
5/1/1953	0.500195	0.594626	0.094
2/1/1984	0.459677	0.55406	0.094
########	0.481327	0.575313	0.094
2/1/1972	0.504456	0.59828	0.094
2/1/1954	0.476899	0.569711	0.093
2/1/1981	0.47432	0.56693	0.093
7/1/1999	0.093235	0.185681	0.092
3/1/1971	0.440459	0.532695	0.092

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

9/1/1971	0.4353317	0.593206	0.158
########	0.4076585	0.552331	0.145
########	0.4220294	0.572444	0.150
########	0.4984536	0.608416	0.110
1/1/1972	0.5335248	0.700894	0.167
2/1/1972	0.504456	0.59828	0.094
3/1/1972	0.507489	0.574548	0.067
4/1/1972	0.371057	0.509676	0.139
5/1/1972	0.3622417	0.521799	0.160
6/1/1972	0.1947846	0.444239	0.249
7/1/1972	0.1909996	0.421284	0.230
8/1/1972	0.2918636	0.505004	0.213
9/1/1972	0.4419676	0.591106	0.149
########	0.1576644	0.341408	0.184
########	0.3361697	0.50991	0.174
########	0.5283074	0.782503	0.254
1/1/1973	0.5010837	0.61667	0.116
2/1/1973	0.2796453	0.501825	0.222
3/1/1973	0.39765	0.541825	0.144
4/1/1973	0.3116845	0.507688	0.196
5/1/1973	0.3586574	0.531904	0.173
6/1/1973	0.3078667	0.510115	0.202
7/1/1973	0.01096808	0.011535	0.001
8/1/1973	0.4793449	0.606023	0.127
9/1/1973	0.3717899	0.553361	0.182
########	0.3433923	0.521561	0.178
########	0.6455432	0.883976	0.238
########	0.484316	0.586186	0.102
1/1/1974	0.6019672	0.77698	0.175
2/1/1974	0.4892811	0.562019	0.073
3/1/1974	0.4824662	0.568259	0.086
4/1/1974	0.2878227	0.44649	0.159
5/1/1974	0.25445	0.492647	0.238
6/1/1974	0.1628572	0.346671	0.184
7/1/1974	0.4100024	0.574663	0.165
8/1/1974	0	0	0.000
9/1/1974	0.09743669	0.221584	0.124
########	0.3191864	0.501204	0.182
########	0.4774396	0.622801	0.145
########	0.5186542	0.684284	0.166

9/1/2001	0.328591	0.515399	0.187
########	0.332637	0.533281	0.201
########	0.461883	0.59156	0.130
########	0.485808	0.575604	0.090
1/1/2002	0.571142	0.778123	0.207
2/1/2002	0.53911	0.752218	0.213
3/1/2002	0.507754	0.615246	0.107
4/1/2002	0.342302	0.514418	0.172
5/1/2002	0.311587	0.505279	0.194
6/1/2002	0.356805	0.517002	0.160
7/1/2002	0.052602	0.100169	0.048
8/1/2002	0	0	0.000
9/1/2002	0.304964	0.523087	0.218
########	0.296641	0.50699	0.210
########	0.272538	0.500758	0.228
########	0.477887	0.621612	0.144
1/1/2003	0.57146	0.799171	0.228
2/1/2003	0.482379	0.578831	0.096
3/1/2003	0.403544	0.531216	0.128
4/1/2003	0.507747	0.632071	0.124
5/1/2003	0.293047	0.505397	0.212
6/1/2003	0.017831	0.04367	0.026
7/1/2003	4.01E-08	4.01E-08	0.000
8/1/2003	0.045397	0.121294	0.076
9/1/2003	0.259288	0.40486	0.146
########	0.509367	0.69792	0.189
########	0.473067	0.617664	0.145
########	0.42006	0.561842	0.142
1/1/2004	0.385591	0.52967	0.144
2/1/2004	0.342844	0.498492	0.156
3/1/2004	0.276752	0.439826	0.163
4/1/2004	0.195486	0.358765	0.163
5/1/2004	0.247051	0.500798	0.254
6/1/2004	0.229509	0.460968	0.231
7/1/2004	0	0	0.000
8/1/2004	0.395047	0.561166	0.166
9/1/2004	0.193775	0.343482	0.150
########	0.324339	0.5037	0.179
########	0.355033	0.524198	0.169
########	0.403231	0.552425	0.149

########	0.33617	0.50991	0.174
########	0.358963	0.532604	0.174
3/1/1964	0.375635	0.549163	0.174
3/1/1949	0.330761	0.504087	0.173
5/1/1973	0.358657	0.531904	0.173
2/1/1996	0.656995	0.830074	0.173
########	0.358614	0.531605	0.173
8/1/1983	0.335909	0.508517	0.173
4/1/2002	0.342302	0.514418	0.172
3/1/1990	0.362046	0.534111	0.172
########	0.505983	0.678046	0.172
4/1/1949	0.10317	0.274826	0.172
9/1/1995	0.218729	0.389618	0.171
3/1/1985	0.337694	0.508571	0.171
########	0.502993	0.673766	0.171
########	0.372704	0.543108	0.170
6/1/2008	0.347324	0.517526	0.170
1/1/1957	0.316119	0.486254	0.170
9/1/1964	0.357805	0.52765	0.170
5/1/1957	0.370277	0.539989	0.170
8/1/1965	0.215167	0.384719	0.170
4/1/1985	0.170901	0.340388	0.169
1/1/1963	0.520259	0.689718	0.169
2/1/1982	0.603908	0.773104	0.169
1/1/2001	0.248988	0.418176	0.169
########	0.355033	0.524198	0.169
6/1/1981	0.338973	0.508084	0.169
########	0.390627	0.559442	0.169
########	0.361555	0.530241	0.169
########	0.346622	0.515098	0.168
########	0.342796	0.510794	0.168
########	0.363514	0.531416	0.168
6/1/1953	0.389546	0.557334	0.168
9/1/1958	0.16352	0.331235	0.168
3/1/1981	0.330382	0.497999	0.168
1/1/1972	0.533525	0.700894	0.167
5/1/1994	0.130606	0.297901	0.167
########	0.165463	0.33267	0.167
########	0.290827	0.457412	0.167
8/1/2004	0.395047	0.561166	0.166

########	0.502442	0.593752	0.091
########	0.497743	0.588999	0.091
3/1/1970	0.514859	0.605849	0.091
1/1/1959	0.460203	0.550168	0.090
########	0.485808	0.575604	0.090
7/1/1981	0.070363	0.159847	0.089
7/1/1980	0.060983	0.148867	0.088
7/1/1990	0.063467	0.151279	0.088
3/1/1951	0.472095	0.559095	0.087
########	0.505691	0.591647	0.086
8/1/1949	0.052685	0.138584	0.086
3/1/1974	0.482466	0.568259	0.086
########	0.500954	0.586585	0.086
1/1/1958	0.461545	0.547115	0.086
2/1/1986	0.48883	0.574097	0.085
8/1/1993	0.068489	0.152957	0.084
2/1/1960	0.500339	0.584431	0.084
2/1/1953	0.466643	0.549654	0.083
2/1/1999	0.512674	0.595341	0.083
7/1/1951	0.050314	0.131306	0.081
2/1/1969	0.493743	0.572258	0.079
6/1/1986	0.047449	0.124744	0.077
4/1/1996	0.4413	0.518348	0.077
8/1/2003	0.045397	0.121294	0.076
3/1/1987	0.492109	0.56777	0.076
2/1/1978	0.503442	0.578822	0.075
7/1/1979	0.067903	0.142752	0.075
2/1/1974	0.489281	0.562019	0.073
3/1/1957	0.501744	0.572922	0.071
3/1/1972	0.507489	0.574548	0.067
2/1/1983	0.511905	0.577698	0.066
2/1/1987	0.545164	0.59479	0.050
7/1/2002	0.052602	0.100169	0.048
7/1/2000	0.029606	0.0756	0.046
8/1/2000	0.028403	0.071657	0.043
9/1/1991	0.103445	0.141577	0.038
8/1/2006	0.02121	0.049982	0.029
8/1/1988	0.020797	0.048901	0.028
8/1/1994	0.019013	0.046788	0.028
6/1/2003	0.017831	0.04367	0.026

APPENDIX B WETLAND PROTECTION
B-2c MR #8 - MONTHLY MEAN AVERAGE VALUES
COMPARE WATER LEVEL FLUCTUTAIONS (WLF)

1/1/1975	0.5202874	0.631448	0.111
2/1/1975	0.4310621	0.529011	0.098
3/1/1975	0.4176209	0.525491	0.108
4/1/1975	0.2584133	0.397411	0.139
5/1/1975	0.3659904	0.520507	0.155
6/1/1975	0.2865245	0.499835	0.213
7/1/1975	0.1767193	0.383713	0.207
8/1/1975	0.4383042	0.579526	0.141
9/1/1975	0.05466184	0.057239	0.003
########	0.3466215	0.515098	0.168
########	0.3968755	0.553362	0.156
########	0.5212243	0.75575	0.235
1/1/1976	0.4306487	0.540963	0.110
2/1/1976	0.5612866	0.774875	0.214
3/1/1976	0.3604791	0.504425	0.144
4/1/1976	0.3348237	0.511348	0.177
5/1/1976	0.3224447	0.513645	0.191
6/1/1976	0.2311757	0.502951	0.272
7/1/1976	0.2357015	0.391706	0.156
8/1/1976	0.3855548	0.54864	0.163
9/1/1976	0.2711586	0.507367	0.236
########	0.2870193	0.521825	0.235
########	0.2154084	0.419241	0.204
########	0.2573929	0.444037	0.187
1/1/1977	0.3198615	0.507573	0.188
2/1/1977	0.3146117	0.509467	0.195
3/1/1977	0.3417374	0.528111	0.186
4/1/1977	0.1784804	0.44532	0.267
5/1/1977	0.2914756	0.50259	0.211
6/1/1977	0.2618913	0.455098	0.193
7/1/1977	0.1480765	0.335409	0.187
8/1/1977	0.4195426	0.562605	0.143
9/1/1977	0.2962181	0.509571	0.213
########	0.2784725	0.489449	0.211
########	0.4211417	0.535618	0.114
########	0.6157556	0.853217	0.237
1/1/1978	0.3689091	0.513806	0.145
2/1/1978	0.5034424	0.578822	0.075
3/1/1978	0.331128	0.513991	0.183
4/1/1978	0.3514734	0.511473	0.160
5/1/1978	0.4179821	0.552474	0.134
6/1/1978	0.4179975	0.575578	0.158
7/1/1978	0.4297459	0.582213	0.152
8/1/1978	0.3236624	0.519624	0.196
9/1/1978	0.3223737	0.51369	0.191

1/1/2005	0.269248	0.469234	0.200
2/1/2005	0.318036	0.492511	0.174
3/1/2005	0.488324	0.625087	0.137
4/1/2005	0.299881	0.478075	0.178
5/1/2005	0.323526	0.501618	0.178
6/1/2005	0.308598	0.529738	0.221
7/1/2005	0.143566	0.289951	0.146
8/1/2005	0.501092	0.599224	0.098
9/1/2005	0.474815	0.596484	0.122
########	0.40221	0.560463	0.158
########	0.345352	0.534362	0.189
########	0.532091	0.754634	0.223
1/1/2006	0.502693	0.624	0.121
2/1/2006	0.348146	0.505818	0.158
3/1/2006	0.304348	0.498117	0.194
4/1/2006	0.321213	0.495557	0.174
5/1/2006	0.432456	0.583916	0.151
6/1/2006	0.187633	0.369792	0.182
7/1/2006	0.275086	0.511151	0.236
8/1/2006	0.02121	0.049982	0.029
9/1/2006	0.191262	0.376084	0.185
########	0.31781	0.528298	0.210
########	0.512854	0.77507	0.262
########	0.485552	0.580298	0.095
1/1/2007	0.400413	0.534463	0.134
2/1/2007	0.405047	0.546327	0.141
3/1/2007	0.440535	0.535748	0.095
4/1/2007	0.257287	0.449583	0.192
5/1/2007	0.325527	0.505925	0.180
6/1/2007	0.241062	0.502665	0.262
7/1/2007	0.160731	0.311678	0.151
8/1/2007	0.199857	0.466889	0.267
9/1/2007	0.398558	0.552779	0.154
########	0.324908	0.515609	0.191
########	0.311565	0.503283	0.192
########	0.475063	0.587082	0.112
1/1/2008	0.333796	0.511191	0.177
2/1/2008	0.437292	0.541061	0.104
3/1/2008	0.388711	0.542767	0.154
4/1/2008	0.349322	0.512462	0.163
5/1/2008	0.525068	0.779752	0.255
6/1/2008	0.347324	0.517526	0.170
7/1/2008	0	0	0.000
8/1/2008	0	0	0.000
9/1/2008	0	0	0.000

########	0.359159	0.525124	0.166
########	0.518654	0.684284	0.166
1/1/1981	0.306919	0.472511	0.166
########	0.363573	0.528774	0.165
9/1/1962	0.369454	0.534595	0.165
3/1/1958	0.400228	0.565264	0.165
1/1/1984	0.328511	0.493526	0.165
7/1/1974	0.410002	0.574663	0.165
8/1/1995	0.170427	0.335087	0.165
9/1/1954	0.127875	0.292209	0.164
2/1/1991	0.507534	0.671266	0.164
########	0.512107	0.675697	0.164
########	0.357033	0.520606	0.164
4/1/2004	0.195486	0.358765	0.163
4/1/2008	0.349322	0.512462	0.163
2/1/1980	0.354799	0.517937	0.163
8/1/1976	0.385555	0.54864	0.163
3/1/2004	0.276752	0.439826	0.163
1/1/1969	0.527588	0.690567	0.163
########	0.379743	0.542514	0.163
5/1/1984	0.352255	0.514767	0.163
2/1/1967	0.346861	0.509326	0.162
1/1/1953	0.527958	0.690198	0.162
########	0.388004	0.550107	0.162
########	0.535897	0.697778	0.162
########	0.383385	0.545252	0.162
5/1/1985	0.404237	0.565385	0.161
9/1/1955	0.383065	0.544102	0.161
6/1/2002	0.356805	0.517002	0.160
4/1/1978	0.351473	0.511473	0.160
########	0.403799	0.563731	0.160
4/1/1952	0.375908	0.535493	0.160
5/1/1972	0.362242	0.521799	0.160
########	0.398542	0.55809	0.160
########	0.35609	0.515401	0.159
9/1/1967	0.149357	0.308521	0.159
5/1/1950	0.224558	0.383682	0.159
########	0.452008	0.611058	0.159
########	0.373453	0.532443	0.159
3/1/1988	0.347806	0.506684	0.159
3/1/1995	0.355976	0.514696	0.159
4/1/1974	0.287823	0.44649	0.159
########	0.40221	0.560463	0.158
########	0.35045	0.508684	0.158
9/1/1971	0.435332	0.593206	0.158

8/1/1996	0.018091	0.042174	0.024
9/1/1999	0.04997	0.064105	0.014
6/1/1987	0.093248	0.103408	0.010
7/1/1949	0.000459	0.009925	0.009
8/1/1986	0.001417	0.009005	0.008
7/1/1953	0.019987	0.02735	0.007
8/1/1959	0.001077	0.008022	0.007
7/1/1969	0.052627	0.058867	0.006
7/1/1991	2.61E-06	0.0044	0.004
7/1/1958	0.064204	0.066783	0.003
9/1/1975	0.054662	0.057239	0.003
########	0.017542	0.019137	0.002
8/1/1998	0.048728	0.049873	0.001
7/1/1952	0.049889	0.050844	0.001
7/1/1968	0.042289	0.043232	0.001
7/1/1973	0.010968	0.011535	0.001
8/1/1955	0.005698	0.006212	0.001
7/1/1970	1.97E-05	0.000499	0.000
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########	0	0	0.000
6/1/1951	0.000231	0.000231	0.000
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8/1/1958	0	0	0.000
7/1/1960	0	0	0.000
7/1/1962	0	0	0.000
9/1/1965	6.2E-08	6.2E-08	0.000
8/1/1967	0	0	0.000
8/1/1969	0	0	0.000
8/1/1970	0	0	0.000
8/1/1974	0	0	0.000
8/1/1981	0	0	0.000
8/1/1984	0	0	0.000
7/1/1994	0	0	0.000
8/1/2002	0	0	0.000
7/1/2003	4.01E-08	4.01E-08	0.000
7/1/2004	0	0	0.000
7/1/2008	0	0	0.000
8/1/2008	0	0	0.000
9/1/2008	0	0	0.000
9/1/1993	4.41E-07	4.37E-07	0.000
7/1/1956	0.000214	1.68E-05	0.000
5/1/1992	0.118637	0.11751	-0.001
1/1/1985	0.097239	0.095204	-0.002
7/1/1984	0.070569	0.062683	-0.008

APPENDIX B-3 Parklands Executive Residential and Parklands Business Park at Camas Meadows Golf Course – MR#7 Flow Control

This project discharges to a Flow Control - exempt receiving water – Lacamas Lake. Responses are included for this section on flow control, but section *2.5.8 Minimum Requirement #8: Wetlands Protection seems more applicable. The wetlands are within the 100 yr flood plain.*

- A hydroperiod analysis has been prepared to satisfy MR#8 without providing flow control.
- This modeling determined that provisions for Flow Control (without infiltration) provided no significant difference for inflow volume to the wetland. When modeled for flow control with infiltration, the hydroperiod results were quite negative for some summer months. This was of concern since the actual infiltration rate might differ from that modeled. A higher field rate than modeled would have greater negative impact on the wetland.

Conclusion: MR #7 Flow Control is not applicable for this project.

2.5.7 Minimum Requirement #7: FlowControl

Applicability

Projects must provide flow control to reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system, into a fresh water - except for projects that discharge to a water in Appendix I-E – Flow Control-Exempt Receiving Waters in accordance with the following restrictions:

• *Direct discharge to the exempt receiving water does not result in the diversion of drainage from any perennial stream classified as Types 1, 2, 3, or 4 in the State of Washington Interim Water Typing System, or Types "S", "F", or "Np" in the Permanent Water Typing System, or from any category I, II, or III wetland; and*

- **The stormwater runoff from this development does not result in the diversion of drainage from any perennial stream .. or from any category I, II, or III wetland;**

• *Flow splitting devices or drainage BMP's are applied to route natural runoff volumes from the project site to any downstream Type 5 stream or category IV wetland:*

- **Flow splitting devices or drainage BMPs are not proposed to route natural runoff volumes from the project site to any downstream Type 5 stream or category IV wetland.**

APPENDIX B-3 Parklands Executive Residential and Parklands Business Park at Camas Meadows Golf Course – MR#7 Flow Control

• *Design of flow splitting devices or drainage BMP's will be based on continuous hydrologic modeling analysis. The design will assure that flows delivered to Type 5 stream reaches will approximate, but in no case exceed, durations ranging from 50% of the 2-year to the 50-year peak flow.*

- **Flow splitting devices or drainage BMPs are not proposed for flows to be delivered to Type 5 stream reaches.**

• *Flow splitting devices or drainage BMP's that deliver flow to category IV wetlands will also be designed using continuous hydrologic modeling to preserve pre-project wetland hydrologic conditions unless specifically waived or exempted by regulatory agencies with permitting jurisdiction; and*

- **An evaluation of runoff flow to the onsite category III wetland was performed with continuous hydrologic modeling that demonstrated that pre-project wetland hydrologic conditions would be preserved with the proposed design.**

• *The project site must be drained by a conveyance system that is comprised entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection, etc.) and extends to the ordinary high water line of the exempt receiving water; and*

- **Our conference call with DOE indicated that this requirement is related to conveyance that discharges to a smaller stream that has fish spawning habitat (salmon spawning in particular).**
- **The conveyance for this site continues through the wetland complex along a shallow, low gradient section to the ordinary high water line of the exempt receiving water, so, this site does not have that situation.**

• *The conveyance system between the project site and the exempt receiving water shall have sufficient hydraulic capacity to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected*
; and

- **The conveyance system between the project site and the exempt receiving water <u>has</u> sufficient hydraulic capacity for this project and upstream projects in a fully developed built out condition. Based on hydraulic capacity modeling analysis of the 100-yr, 24-hr release flows through five cross sections along the conveyance to the lake, the maximum increases ranged from 0.10 ft to a maximum of 0.27 ft and no significant increase in**

APPENDIX B-3 Parklands Executive Residential and Parklands Business Park at Camas Meadows Golf Course – MR#7 Flow Control

velocity. These analysis results confirm that there are no site specific hydraulic capacity concerns.

• *Any erodible elements of the manmade conveyance system must be adequately stabilized to prevent erosion under the conditions noted above.*

If the discharge is to a stream that leads to a wetland, or to a wetland that has an outflow to a stream, both this requirement and Minimum Requirement #8 apply.

- **There are no elements in the proposed stormwater management design that will introduce erodible elements onsite or to the wetland complex and outfall conveyance as a whole. The modeled peak flow velocity within the wetland is a maximum of 0.7 fps (which is much less than the threshold for erosive concerns at 3 fps) and confirms there are no erosive concerns as proposed.**

Local governments may petition Ecology to exempt projects in additional areas. A petition must justify the proposed exemption based upon a hydrologic analysis that demonstrates that the potential stormwater runoff from the exempted area will not significantly increase the erosion forces on the stream channel nor have near field impacts.

Summary:

- **There are no elements in the proposed stormwater management design that will introduce erodible elements onsite or to the wetland complex and outfall conveyance as a whole.**
- **Our conference call with DOE indicated that this requirement is related to conveyance that discharges to a smaller stream that has fish spawning habitat (salmon spawning in particular). The conveyance for this site continues through the wetland complex along a shallow, low gradient section to the ordinary high water line of the exempt receiving water, so, this site does not have that situation.**
- **The conveyance system between the project site and the exempt receiving water <u>has</u> sufficient hydraulic capacity for this project and upstream projects in a fully developed built out condition. There are no elements in the proposed stormwater management design that will introduce erodible elements onsite or to the wetland complex and outfall conveyance as a whole.**
- **Based on these results and findings, the requirements of Minimum Requirement #7 – Flow Control are not applicable to the site.**

APPENDIX B-3 Parklands Executive Residential and Parklands Business Park at Camas Meadows Golf Course – MR#7 Flow Control

APPENDIX C

Appendix C Runoff Treatment

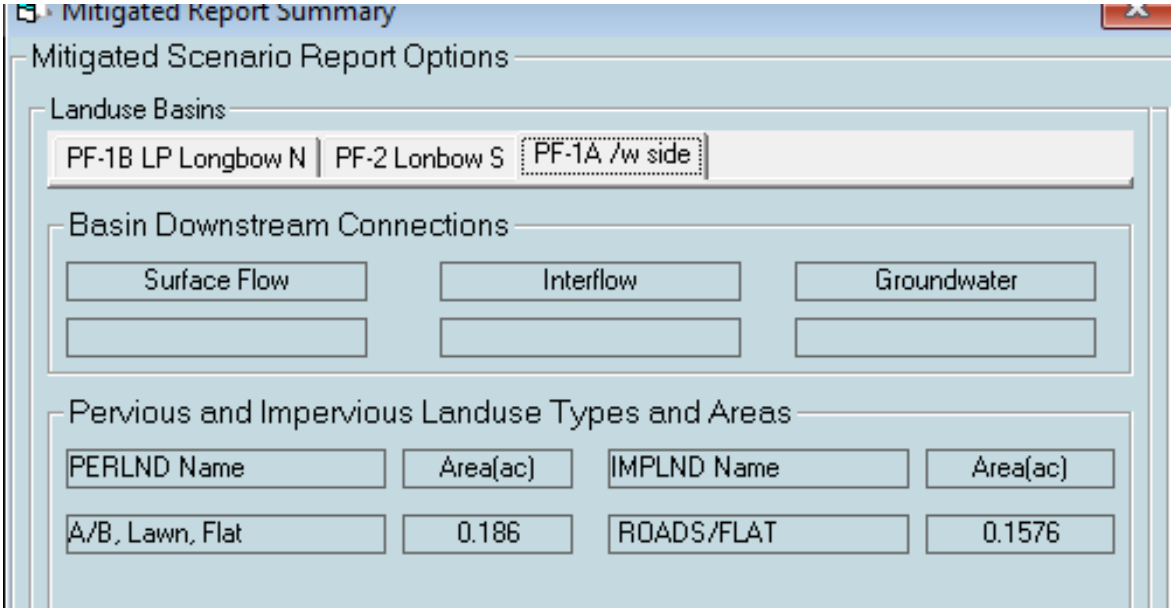
C-1 Water Quality Flow Rates

C-2 Perk Filter System Summary

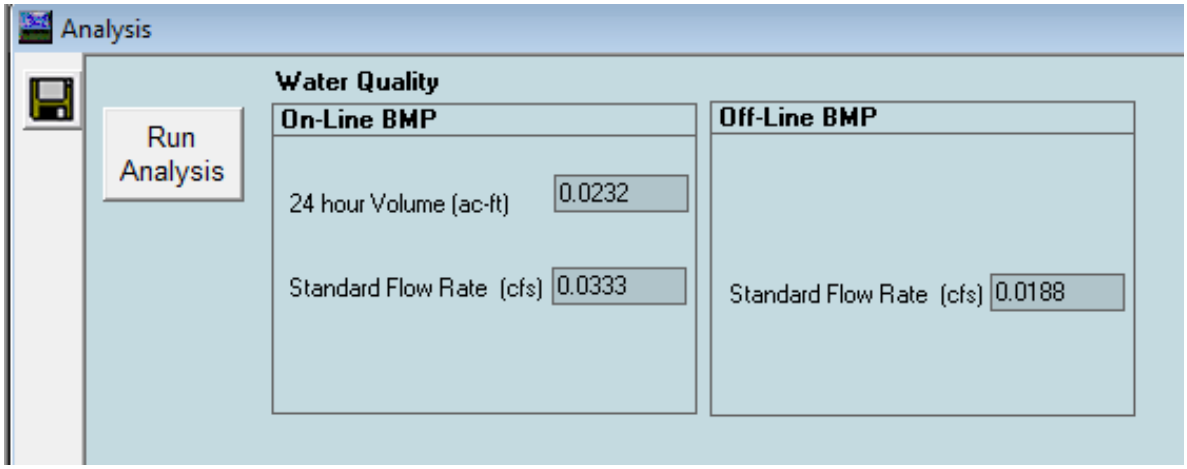
C-3 Phosphorus Reduction

APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-1A Longbow Ln. (west side)

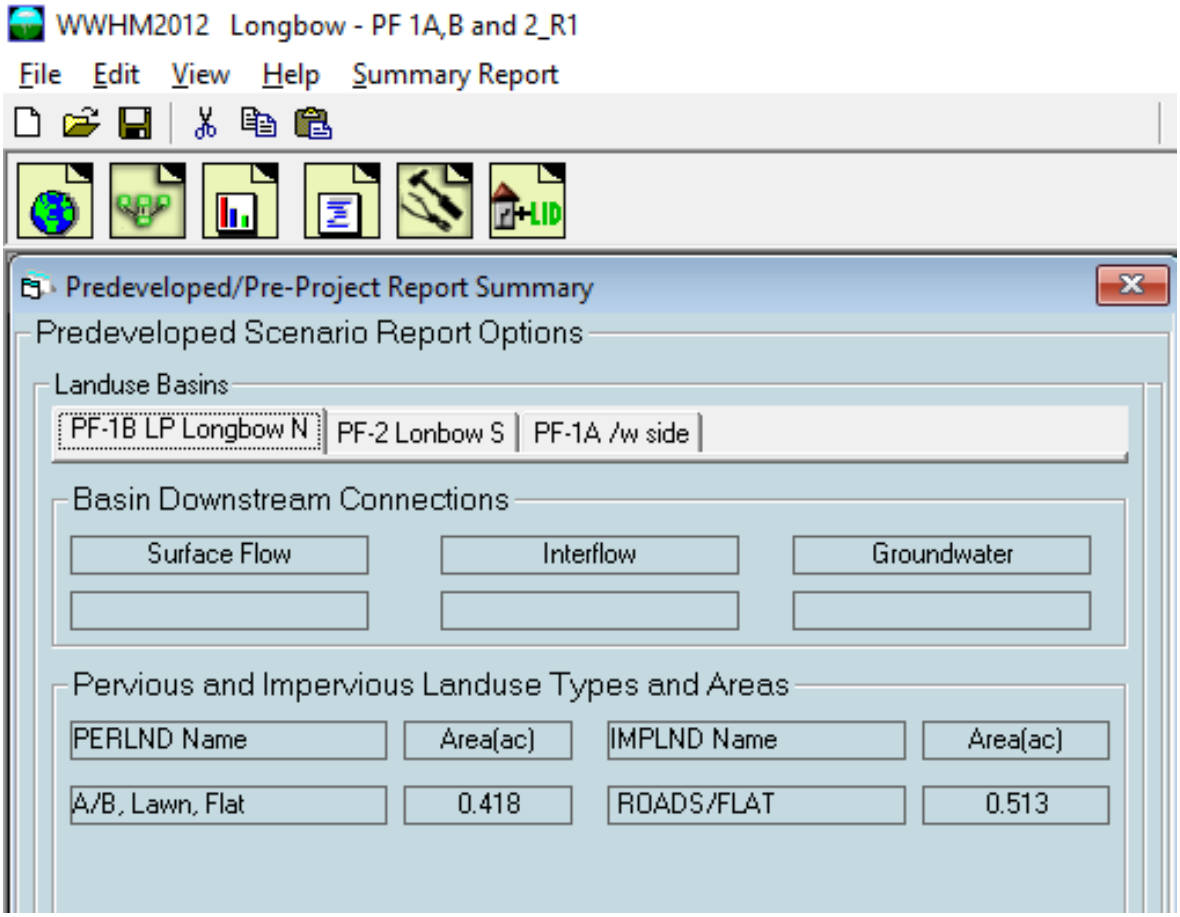


PF-1A Longbow Ln. (west side)

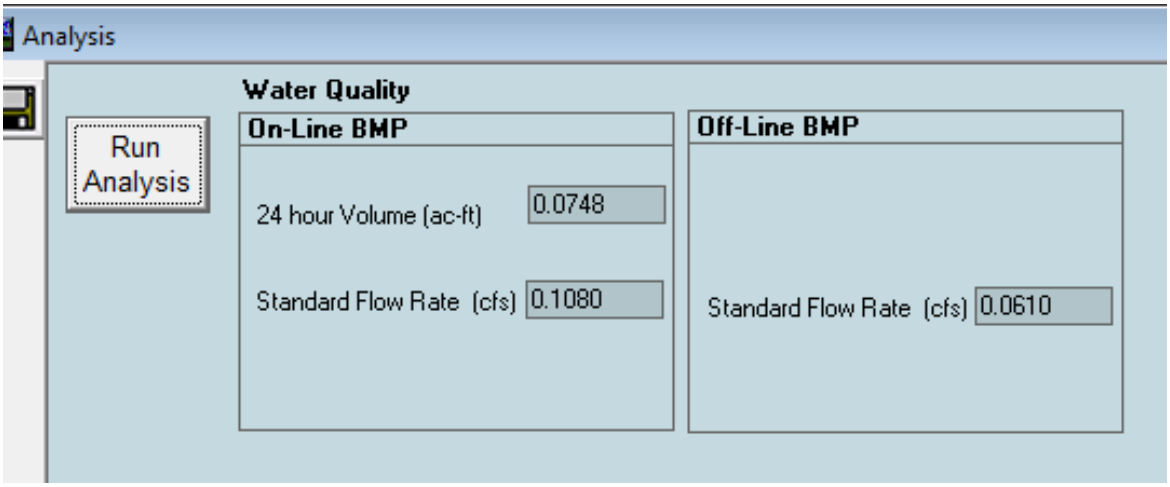


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-1B Longbow Ln. (north low point)

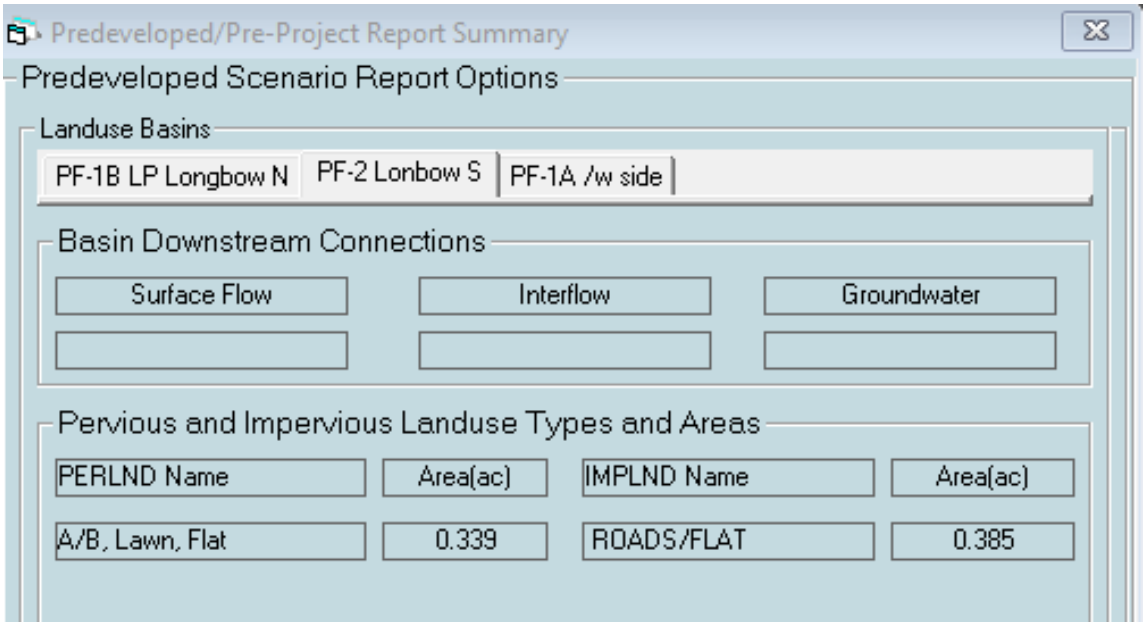


PF-1B Longbow Ln. (north low point)

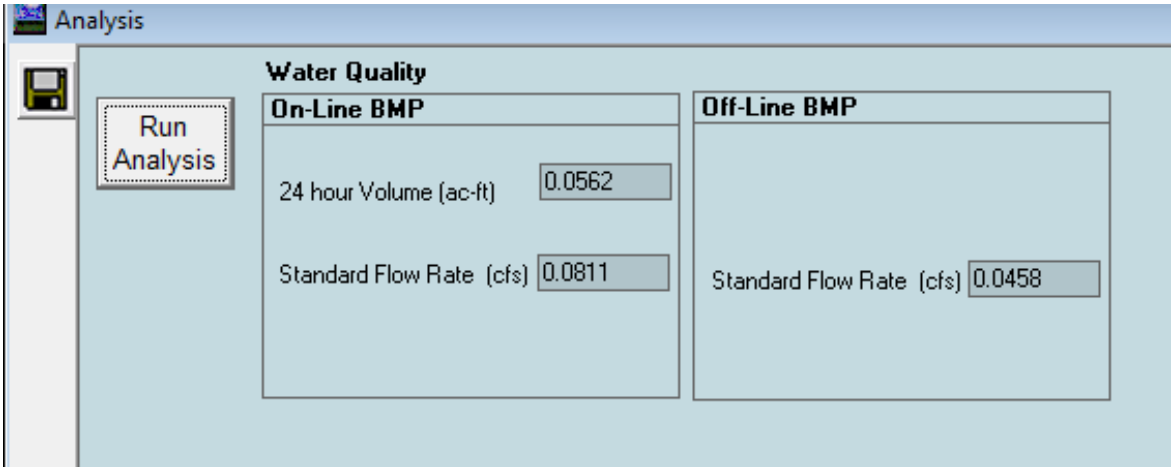


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-2 Longbow Ln. (south low point)

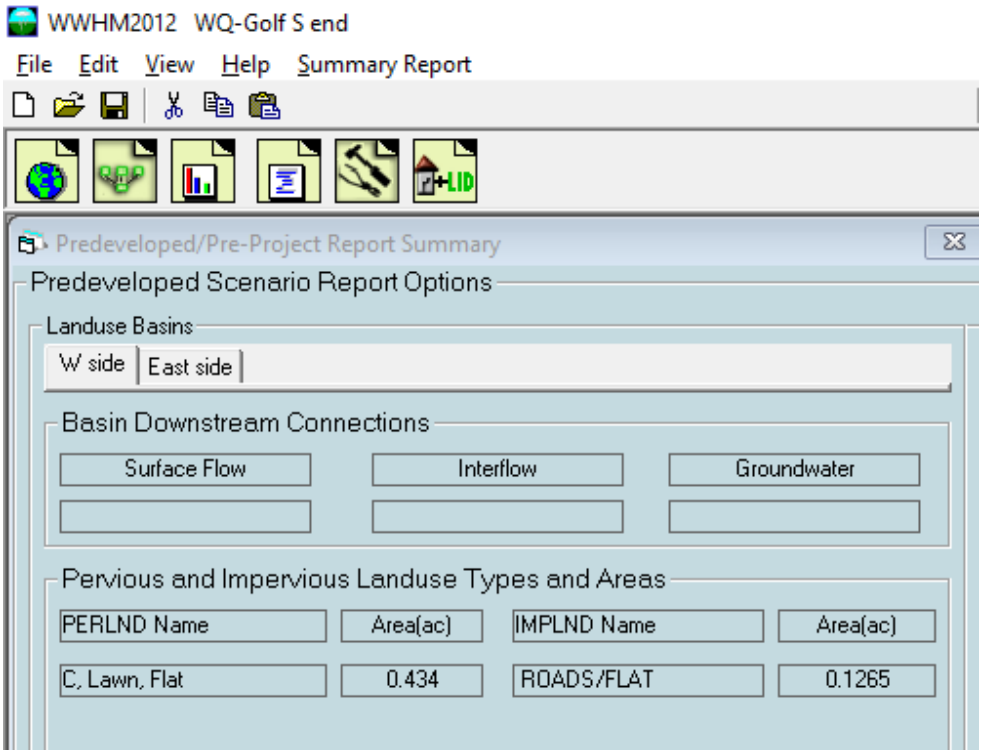


PF-2 Longbow Ln. (south low point)

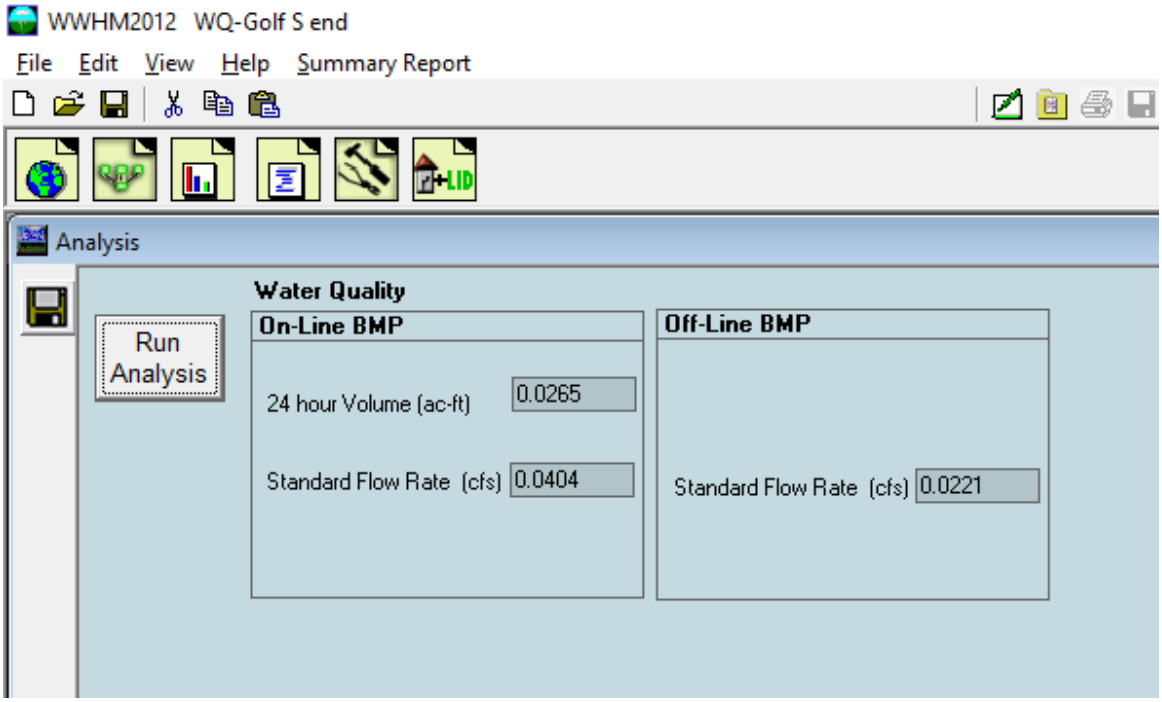


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

McMaster Dr. (PF-8 and PF-9) Same area input

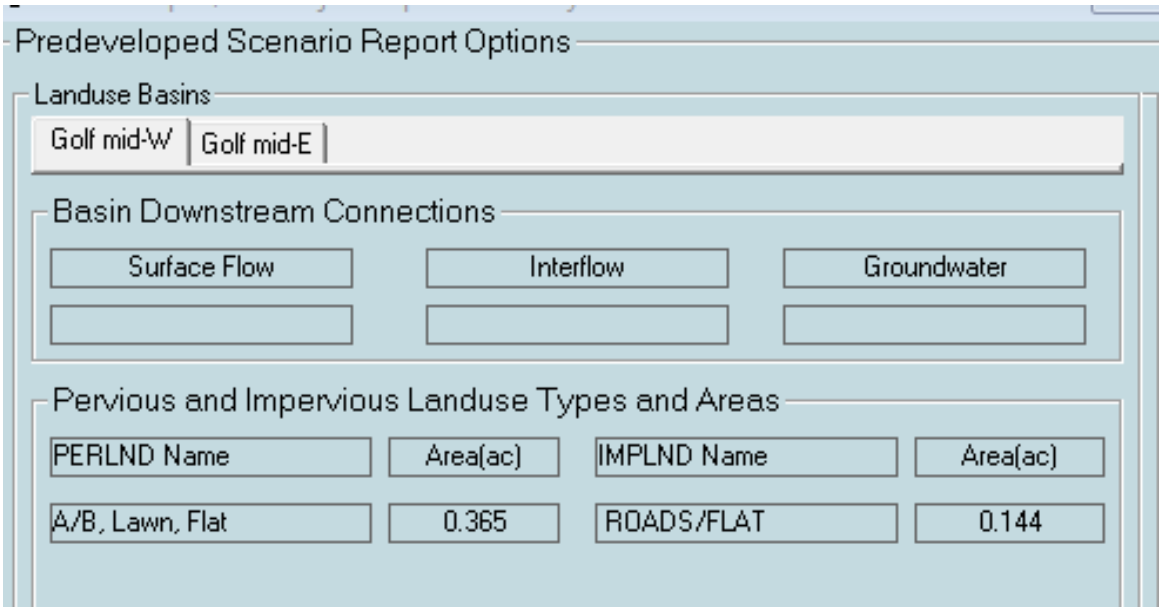


McMaster Dr. (PF-8 and PF-9) Same rate

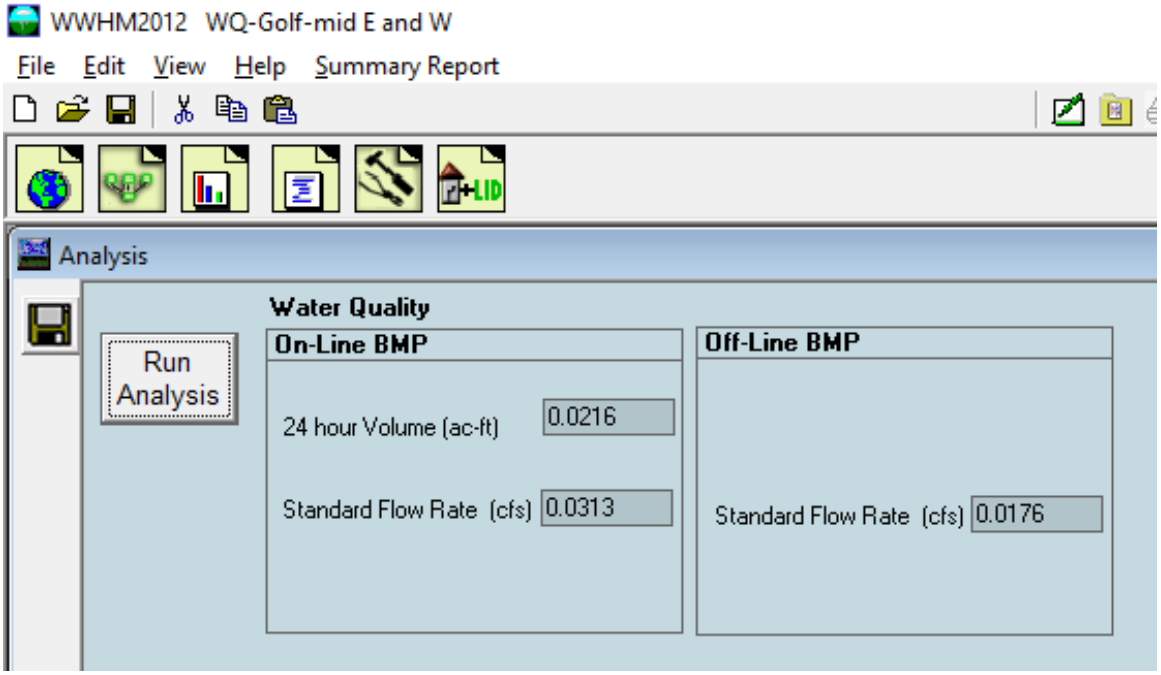


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

McMaster Dr. (PF 6 and PF-7) Same area input

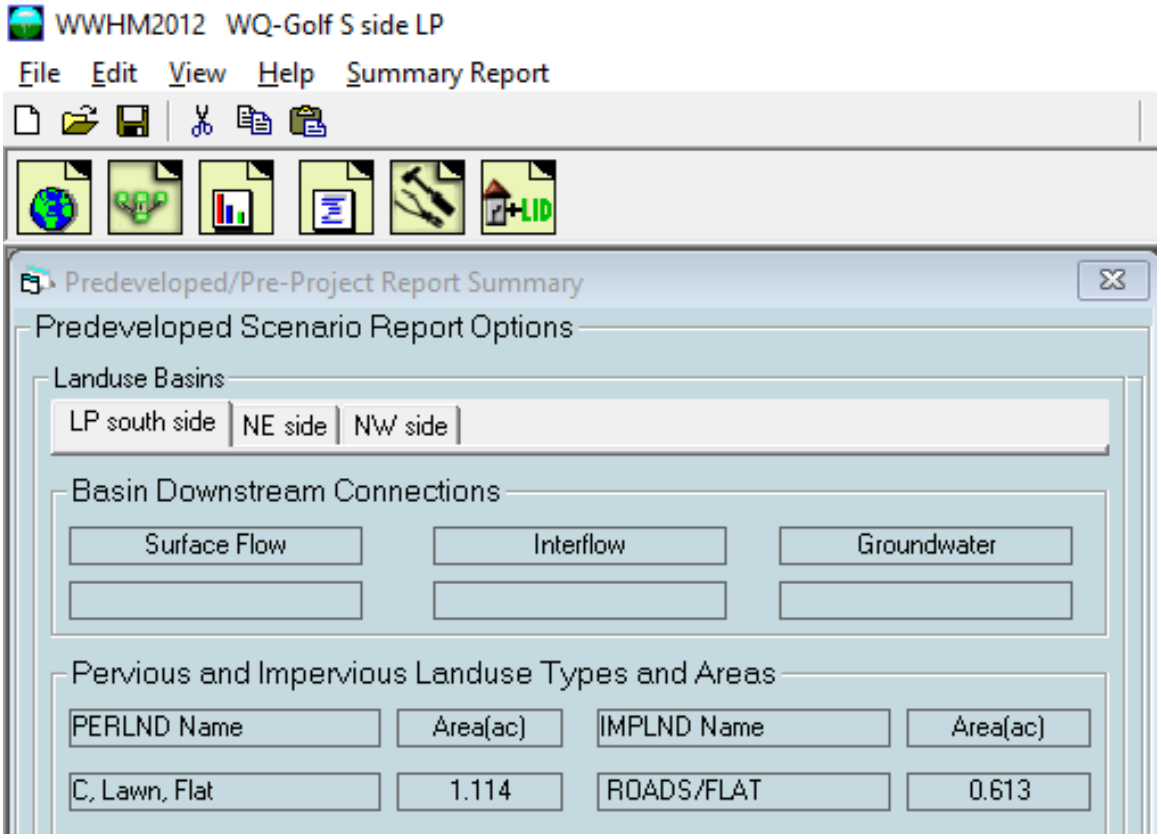


PF-6 and PF-7 (same area, same WQ rate)

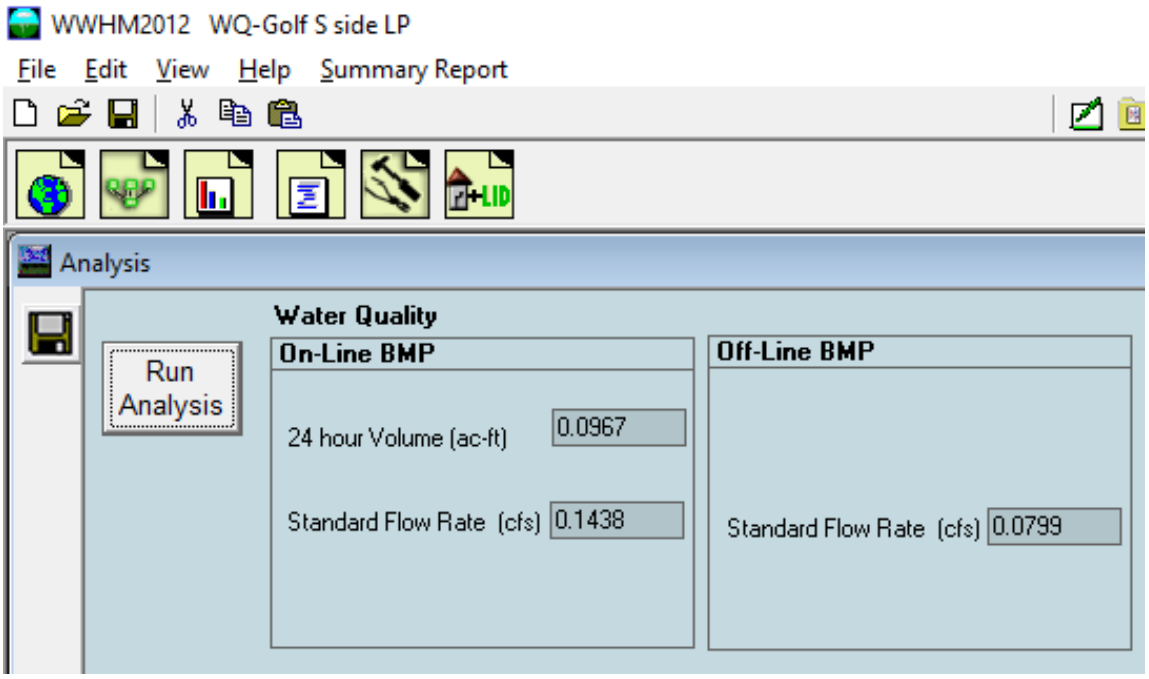


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

McMaster Dr. (PF-5)

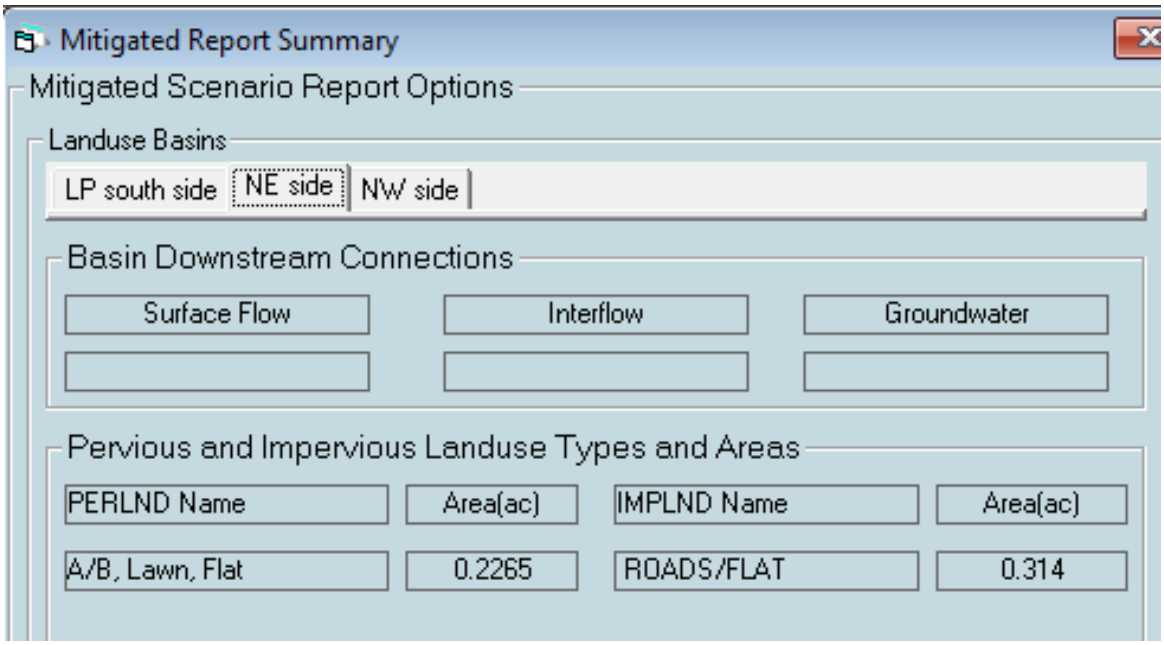


McMaster Dr. (PF-5)

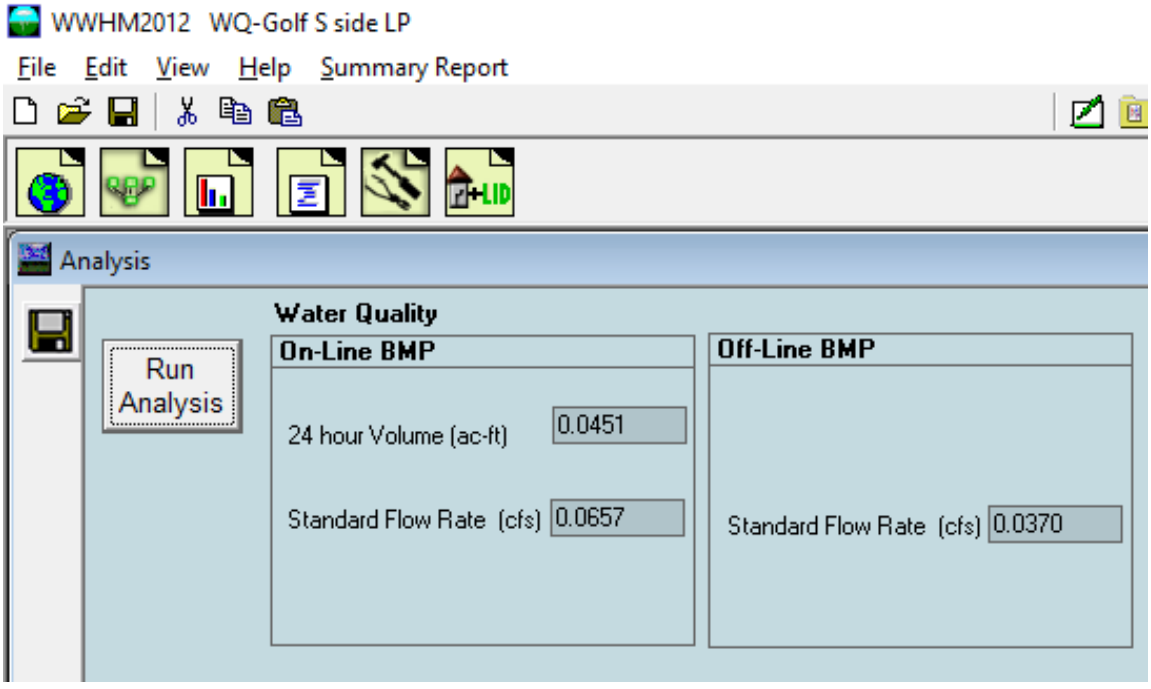


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

McMaster Dr. (NE corner with Longbow Ln. (PF-4)

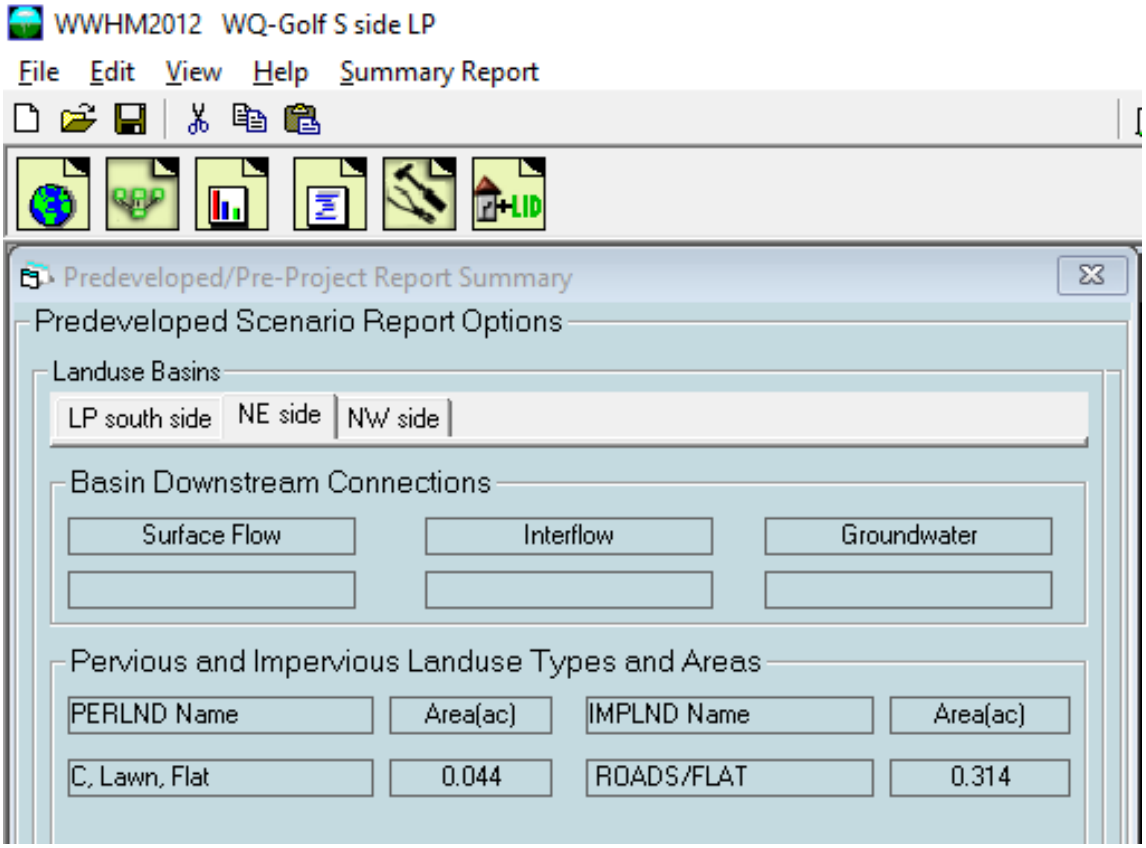


McMaster Dr. (NE corner with Longbow Ln. (PF-4)

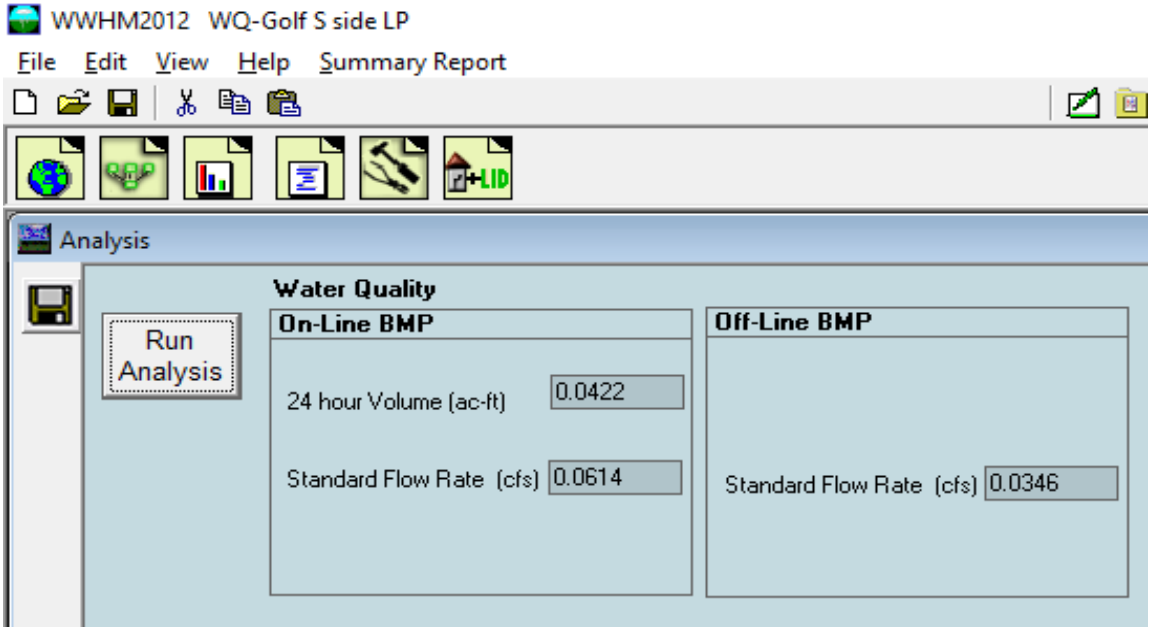


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

McMaster Dr. (NW corner with Longbow Ln. (PF-3)

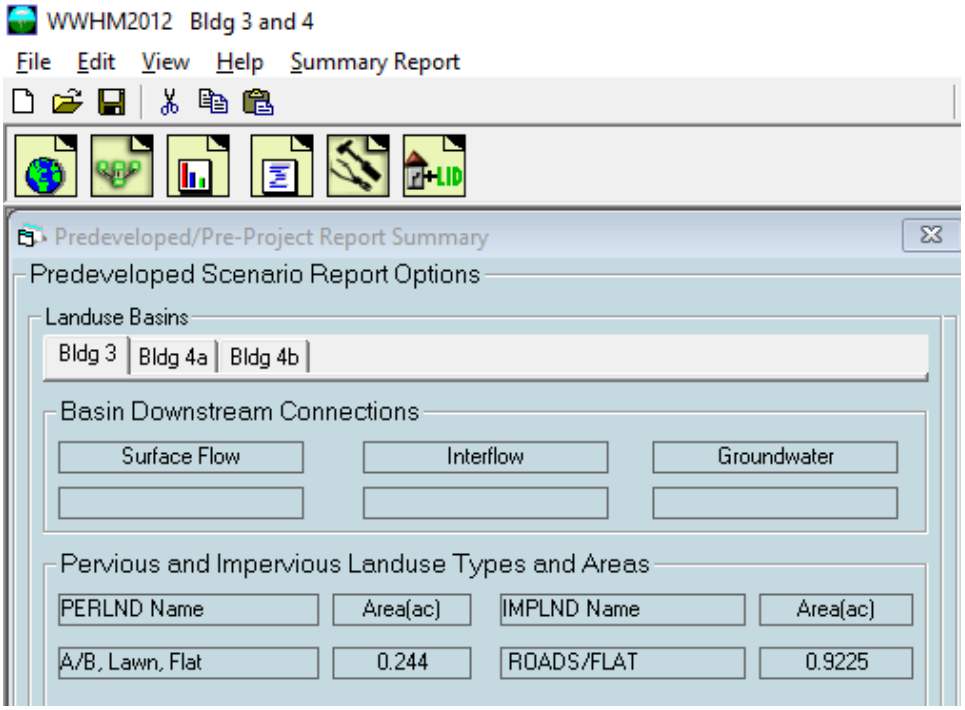


McMaster Dr. (NW corner with Longbow Ln. (PF-3)

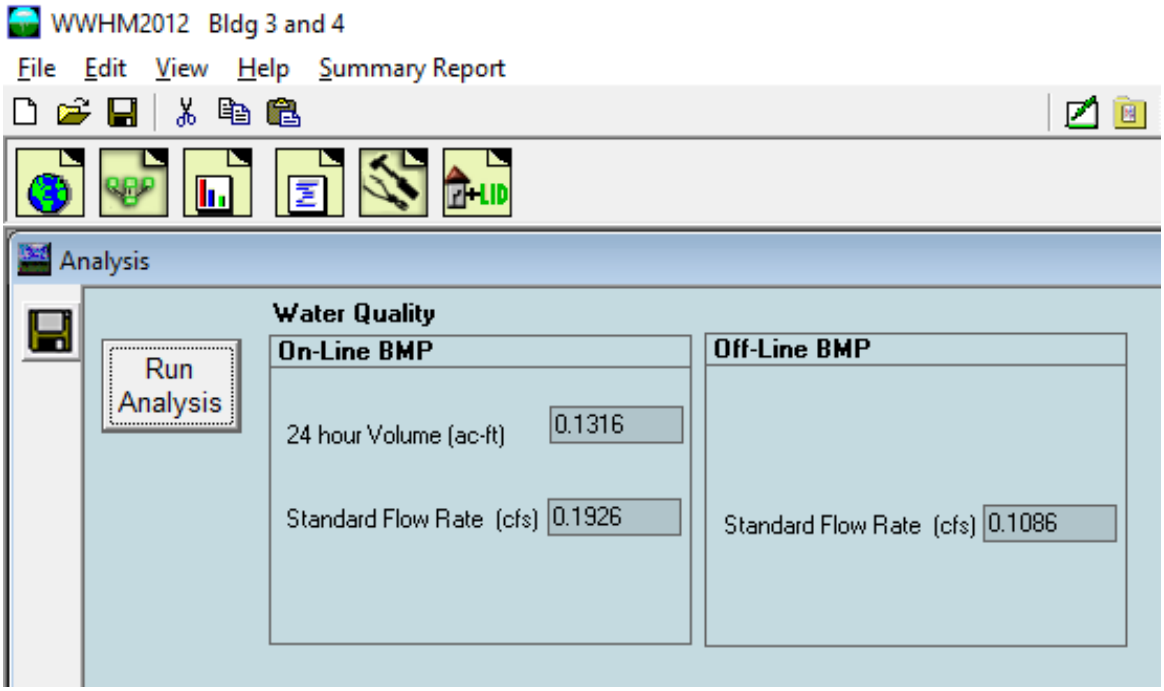


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

BLDG 3 (PF-12)

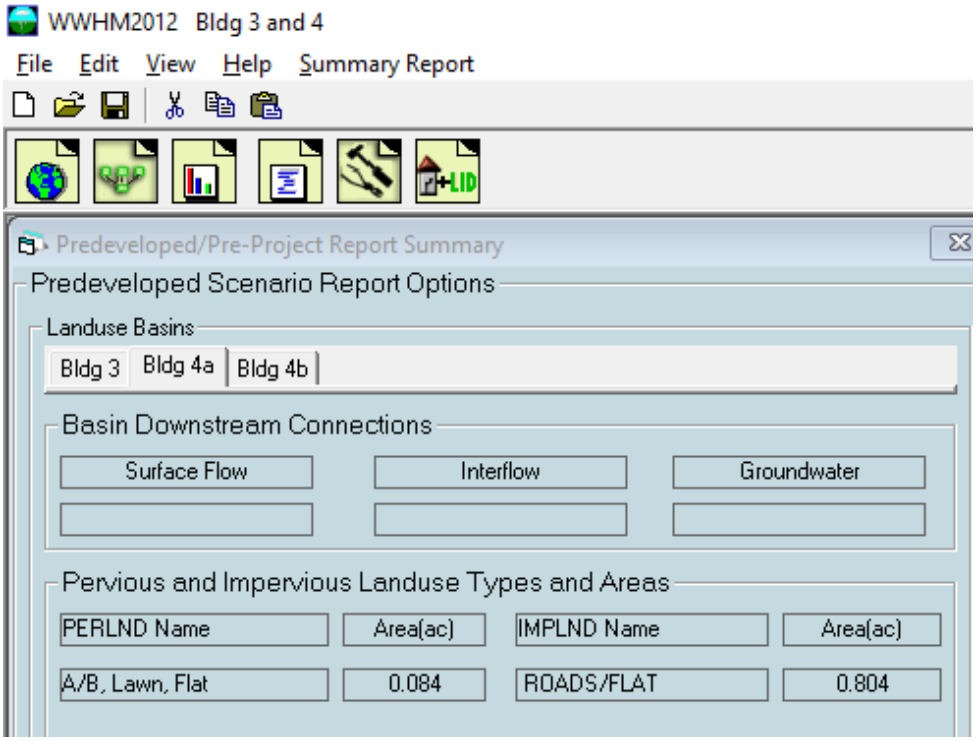


BLDG 3

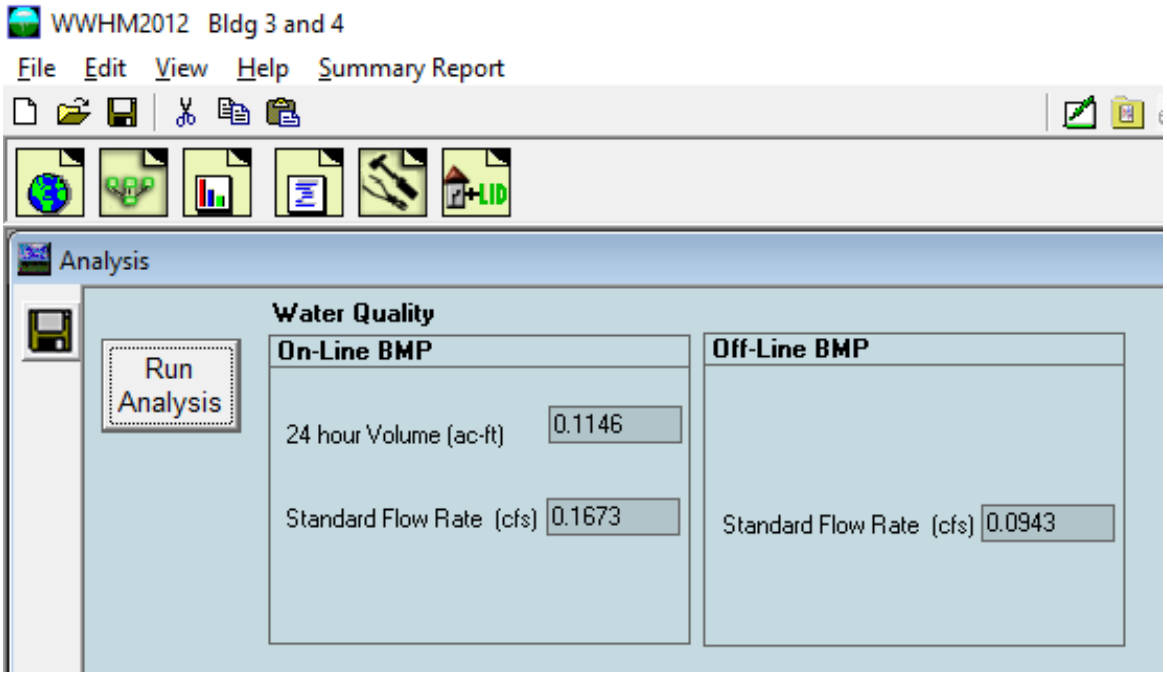


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

BLDG 4a (PF-11)

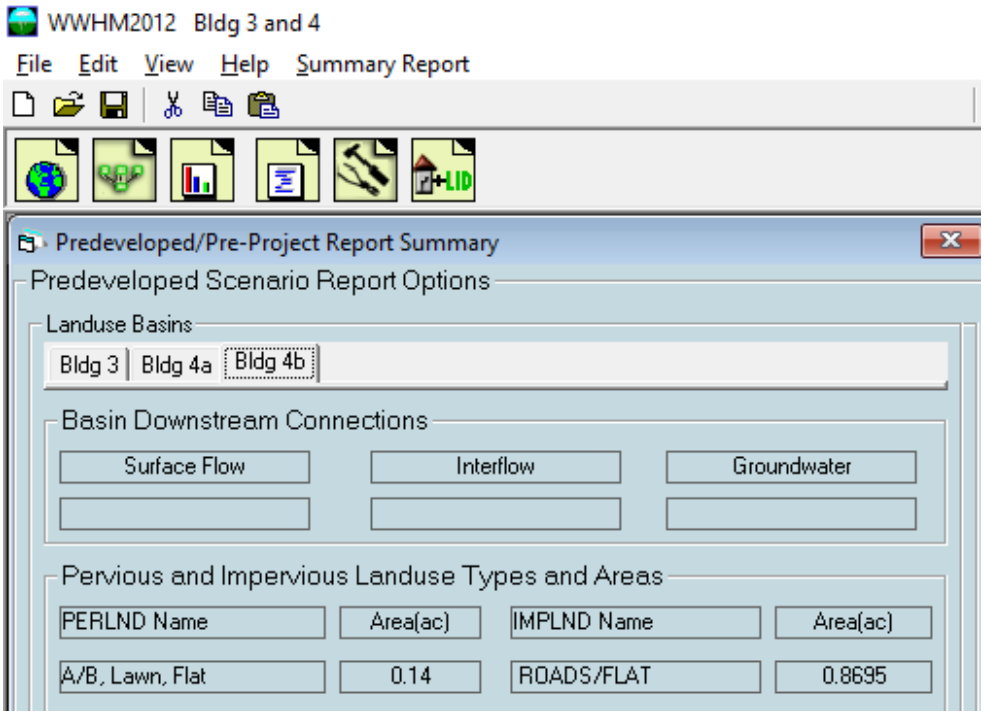


BLDG 4a

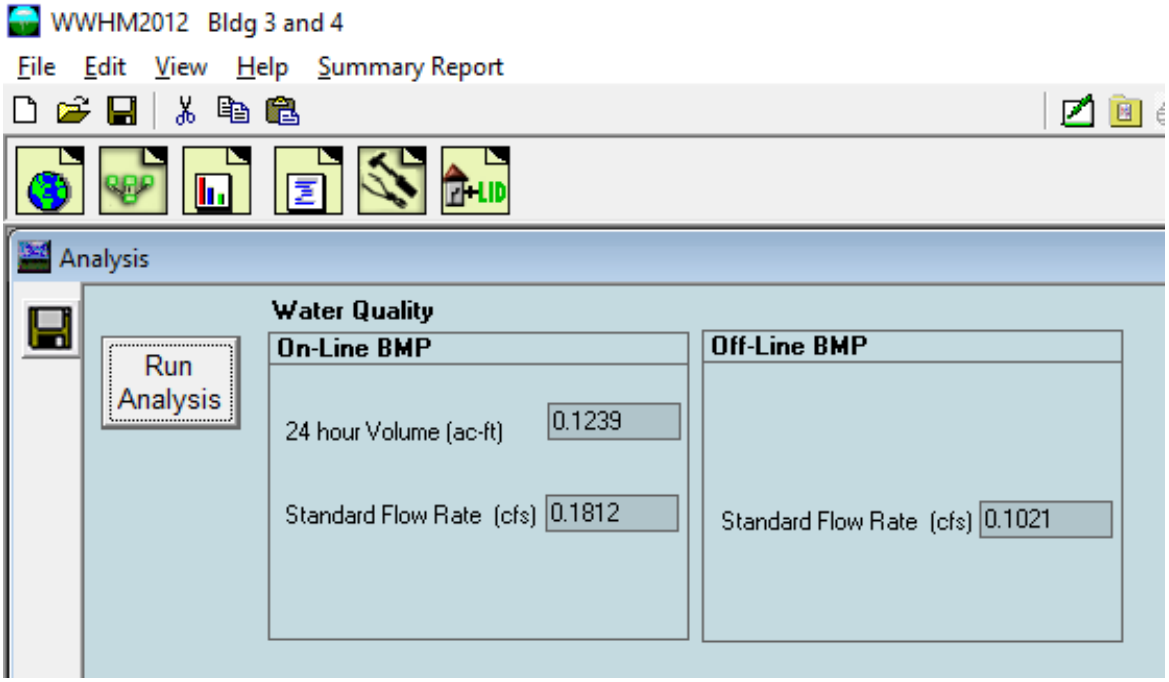


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

BLDG 4b (PF-10)

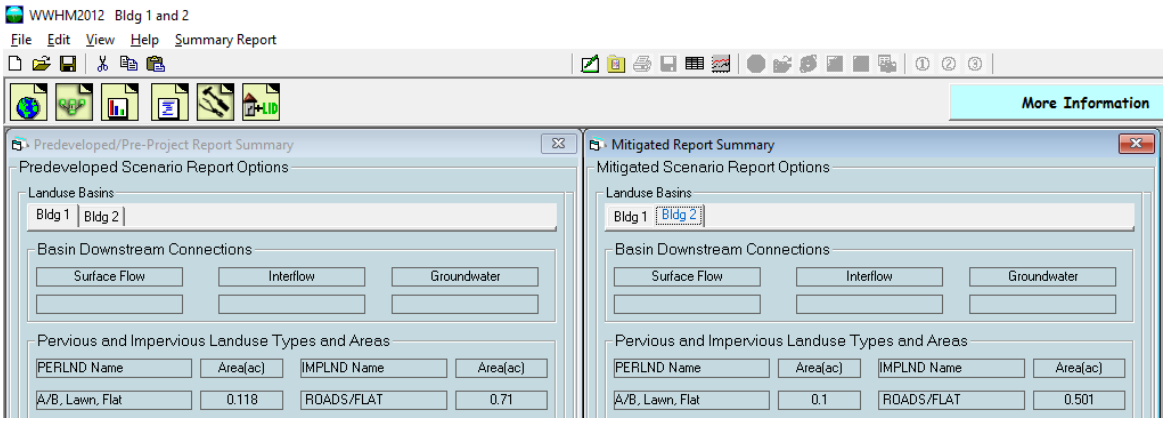


BLDG 4b

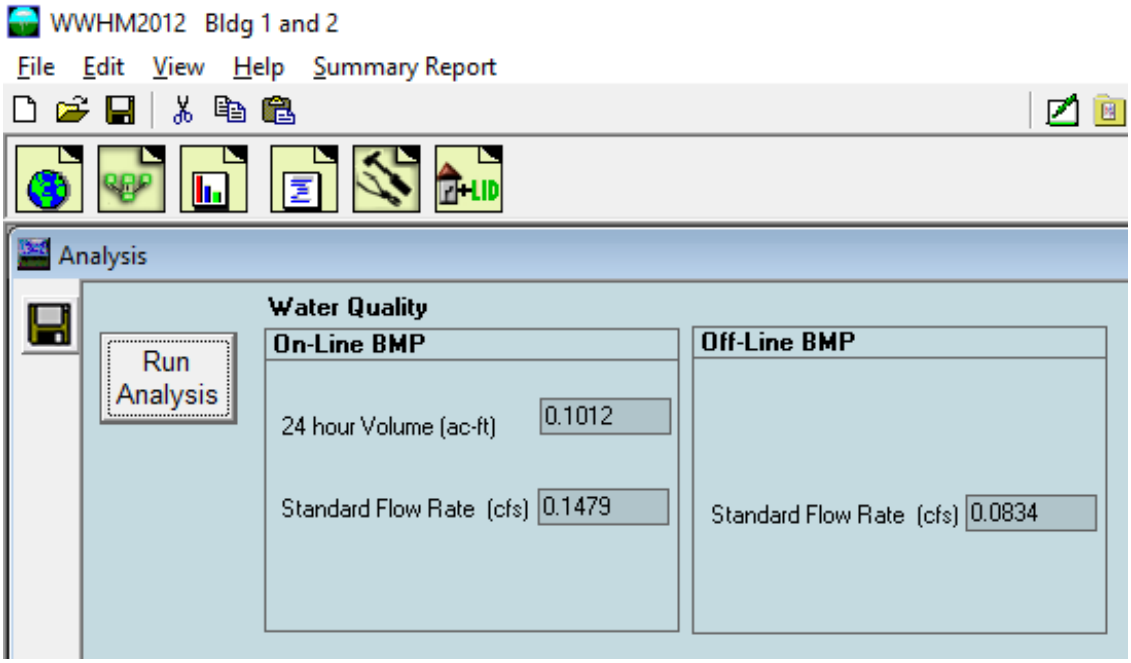


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

BLDG 1 and 2 (PF-14 and PF-13)

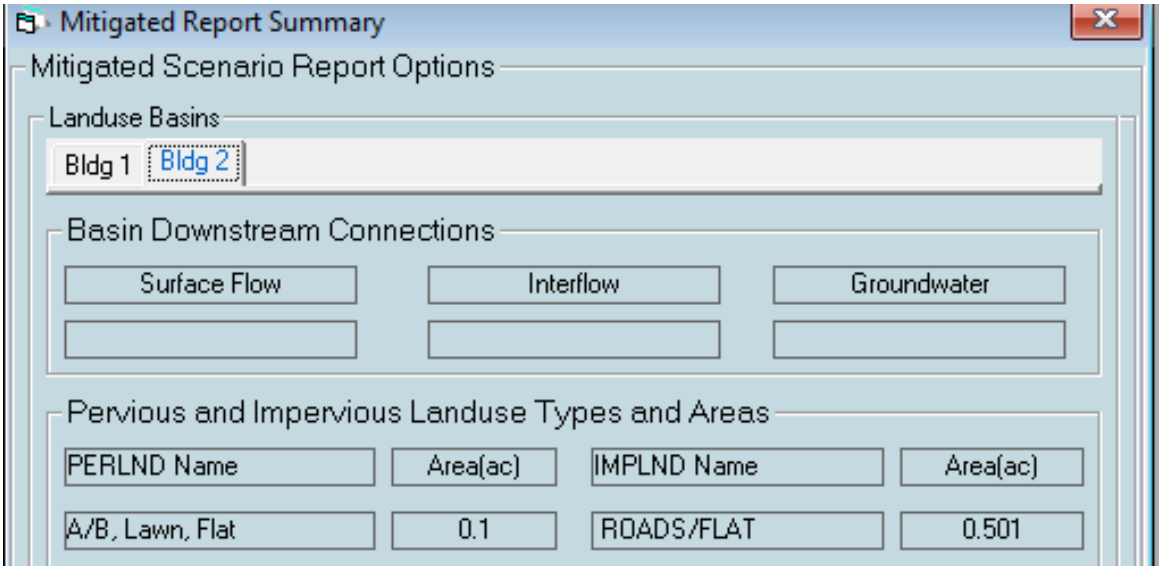


BLDG 1 (PF-14)

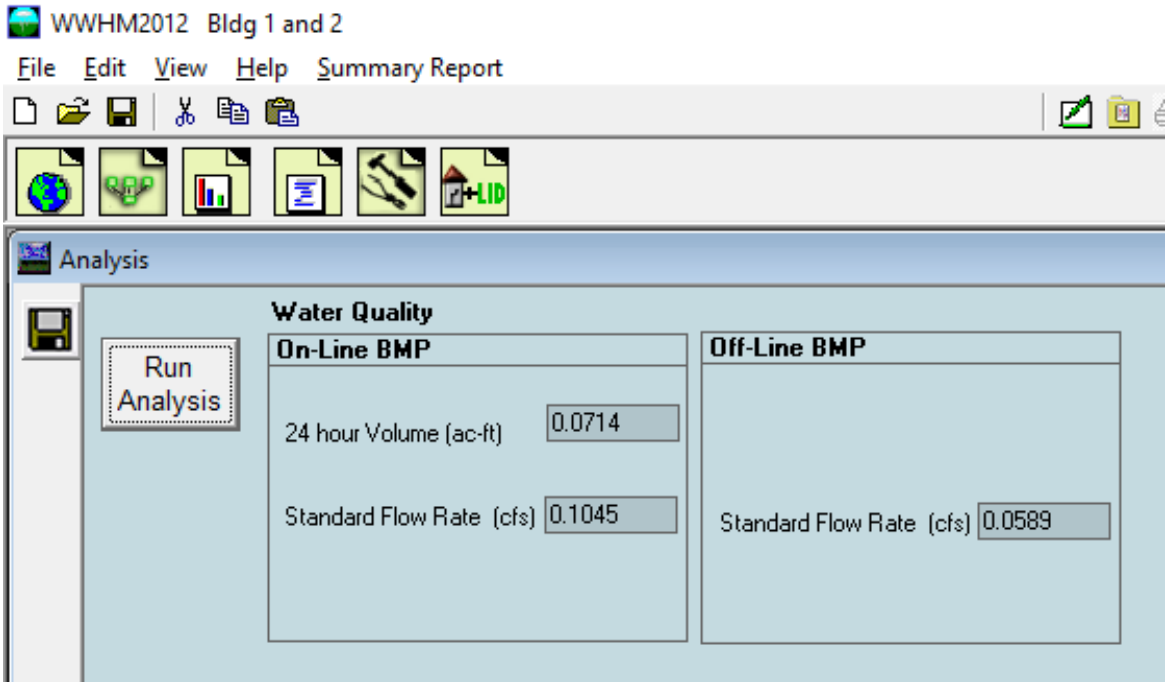


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

BLDG 2 (PF-13)

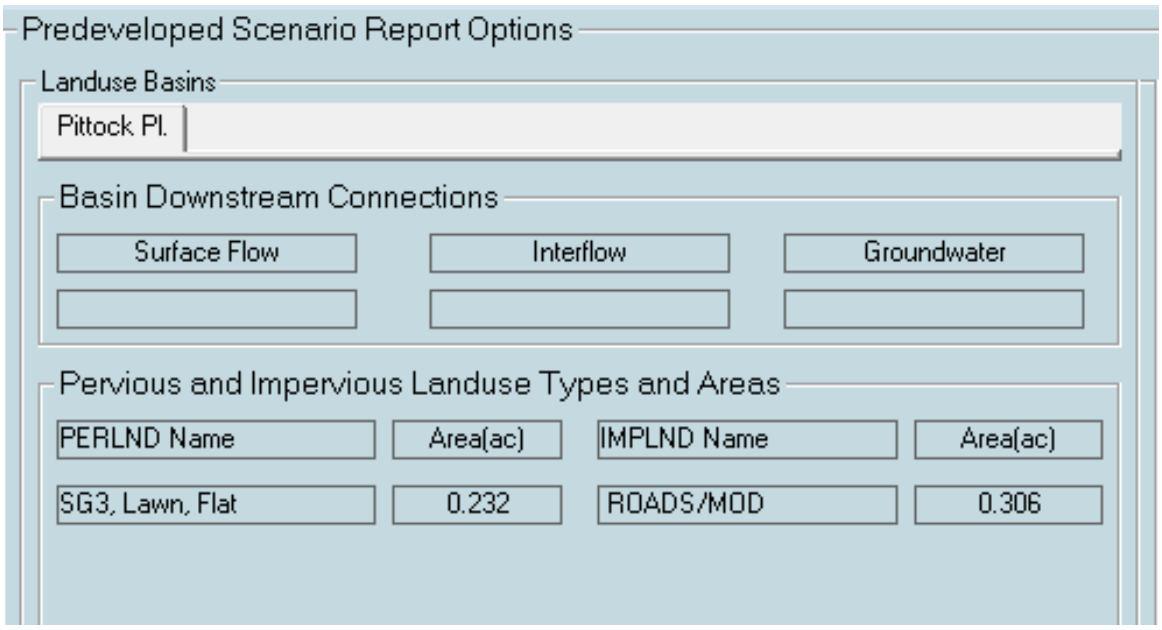


BLDG 2 (PF-13)

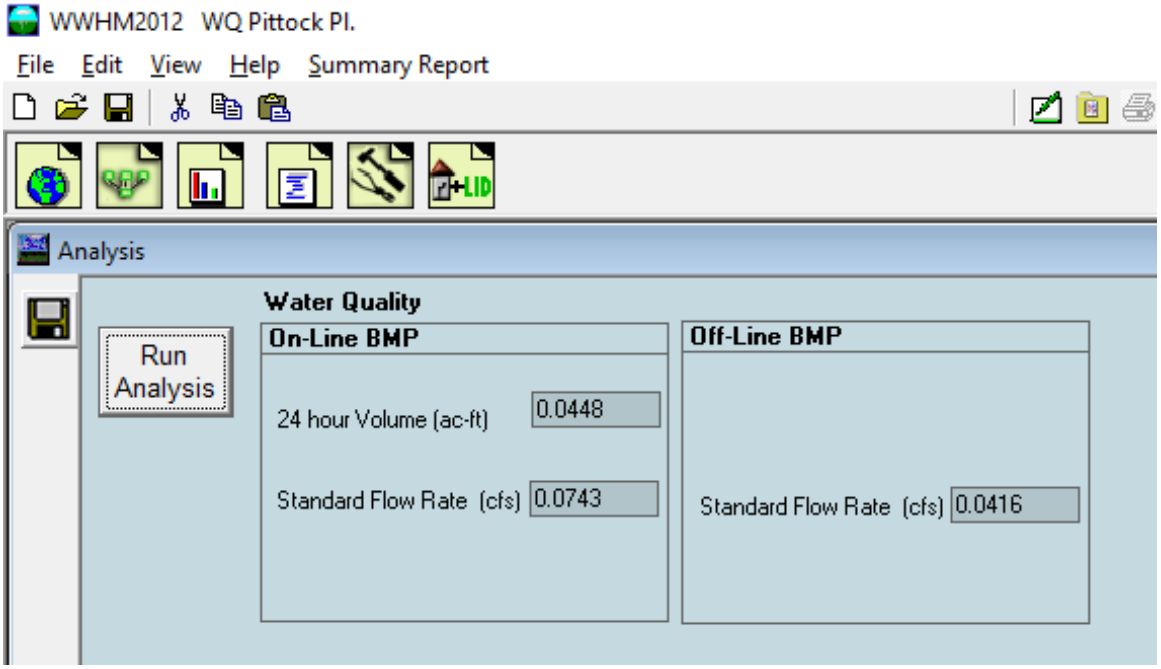


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-15 Pittock Place Areas

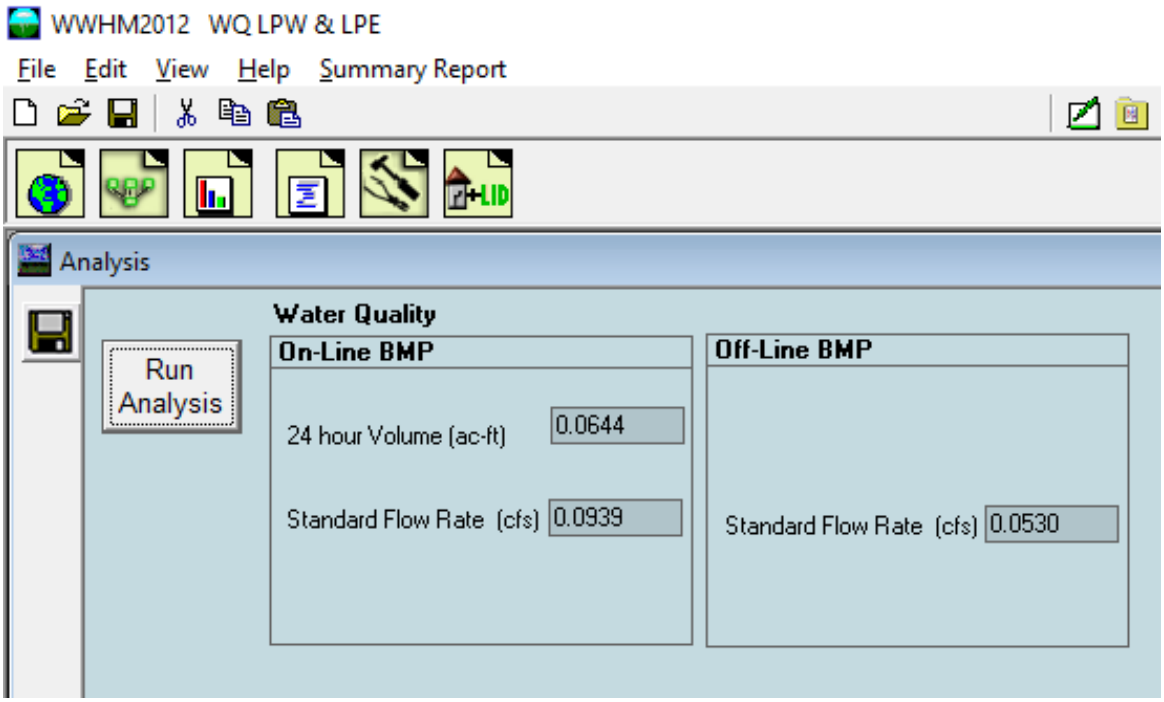


PF-15 Pittock Place

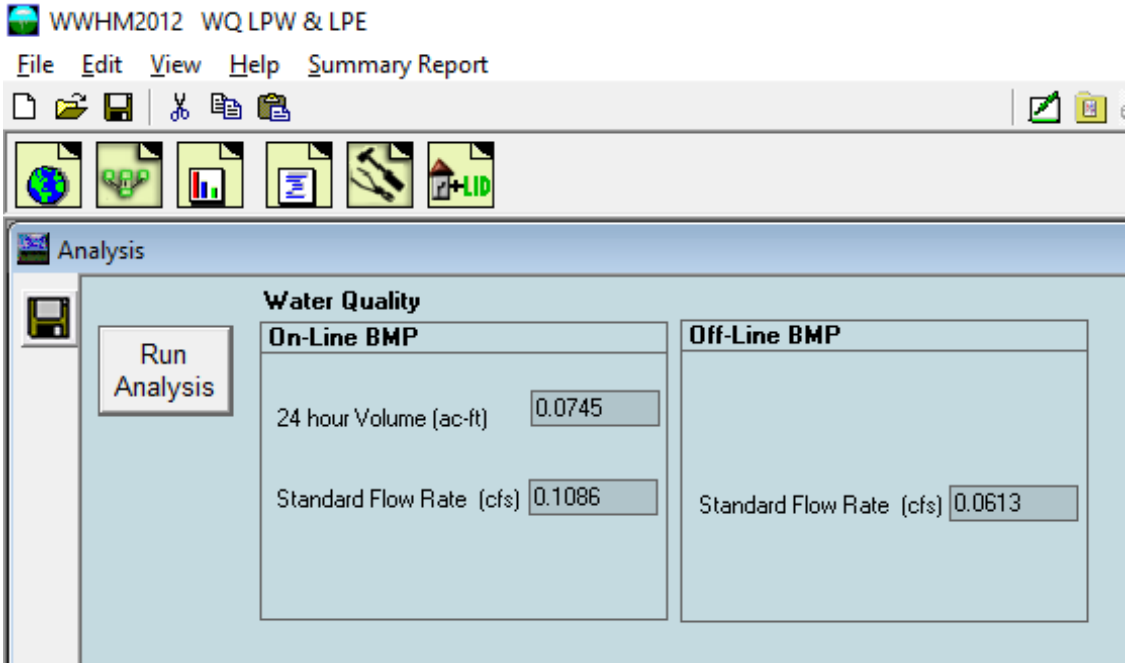


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

LPW (PF-16) Lower Parking Area - west side

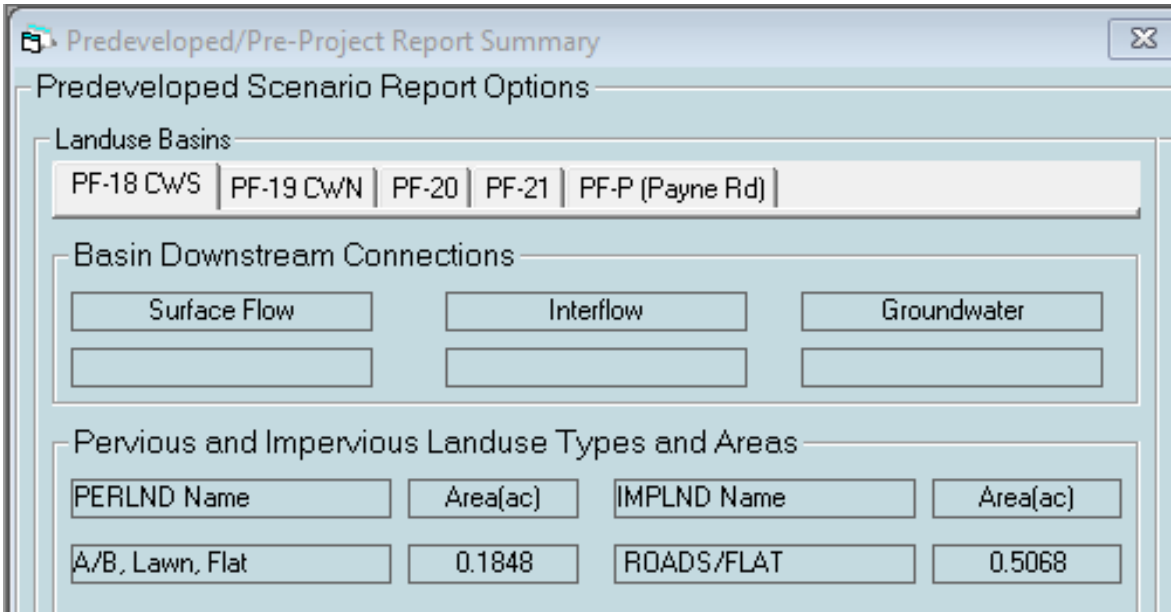


LPE (PF-17) Lower Parking Area – east side

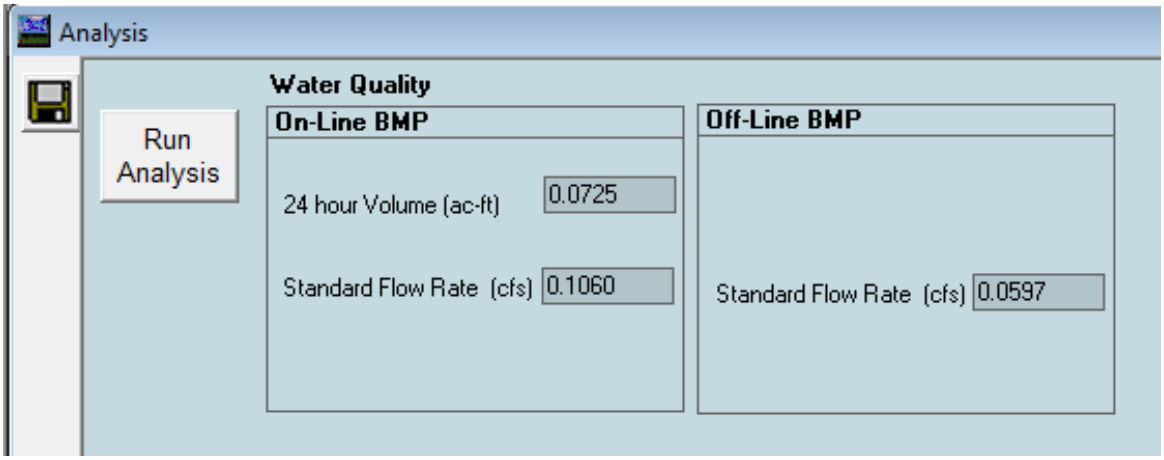


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-18 Area (Camas Meadows Dr.)

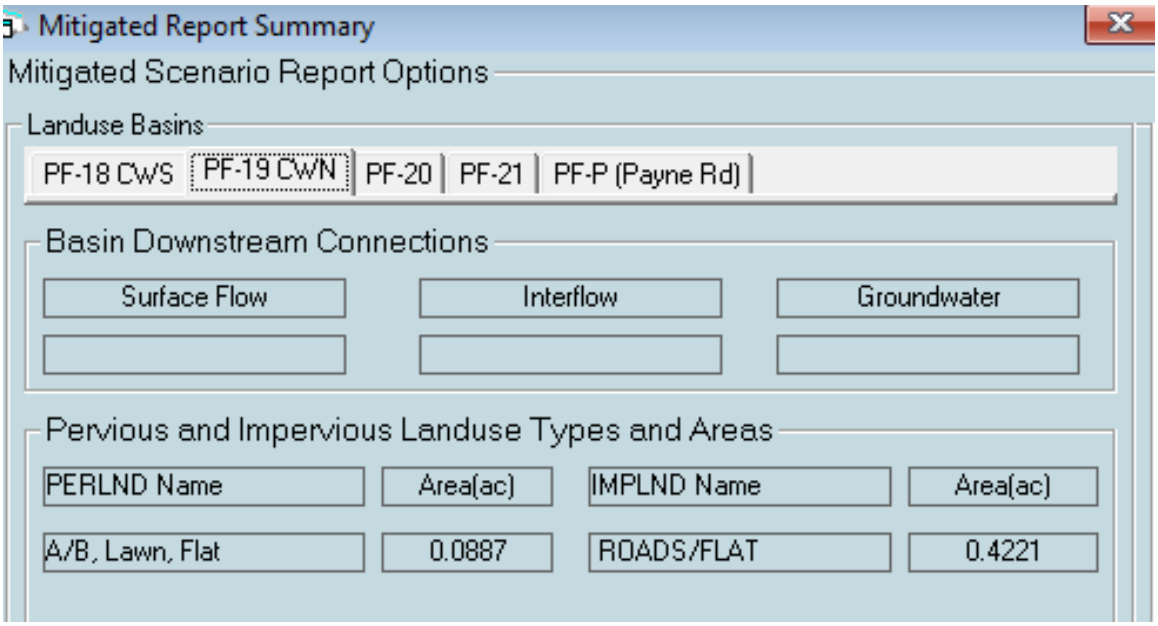


PF-18 WQ FLOW RATE

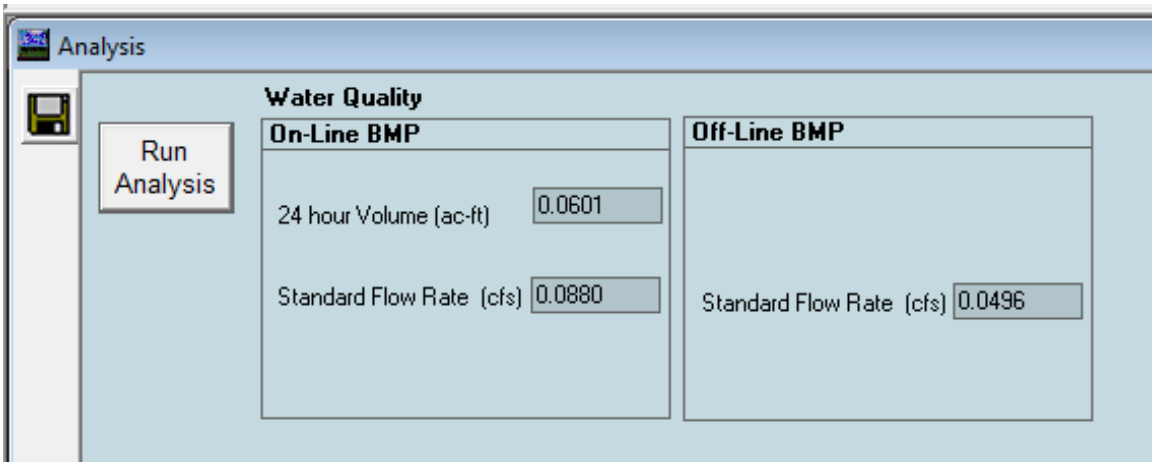


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-19 Area (Camas Meadows Dr.)

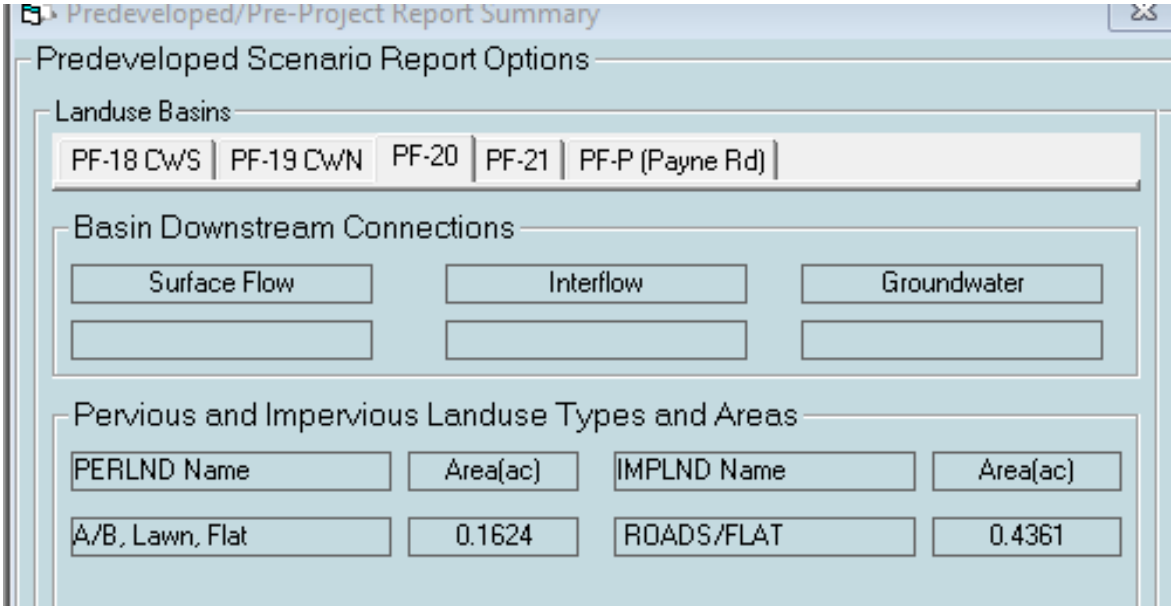


PF-19 WQ FLOW RATE

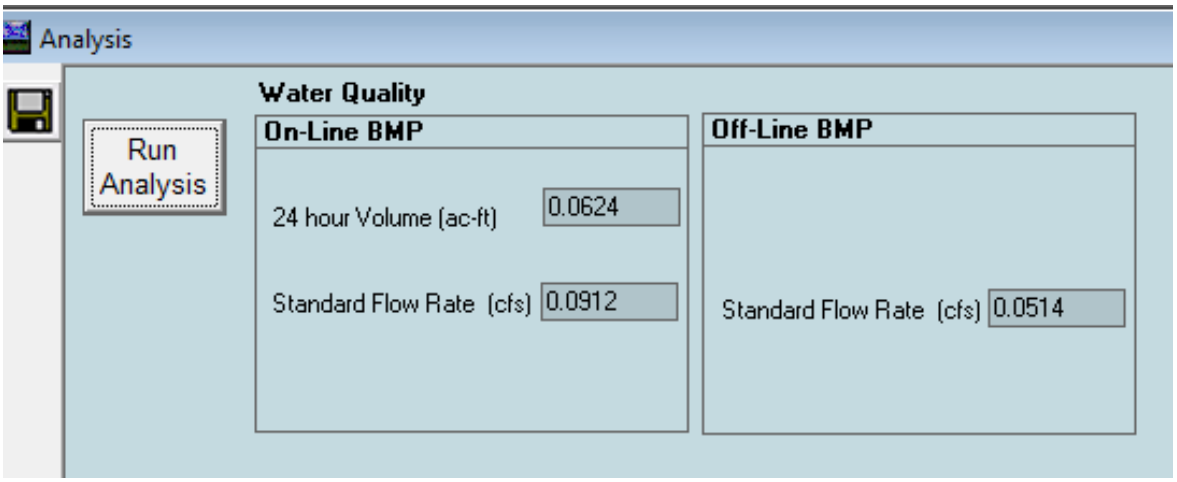


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-20 AREA (Camas Meadows Dr.)

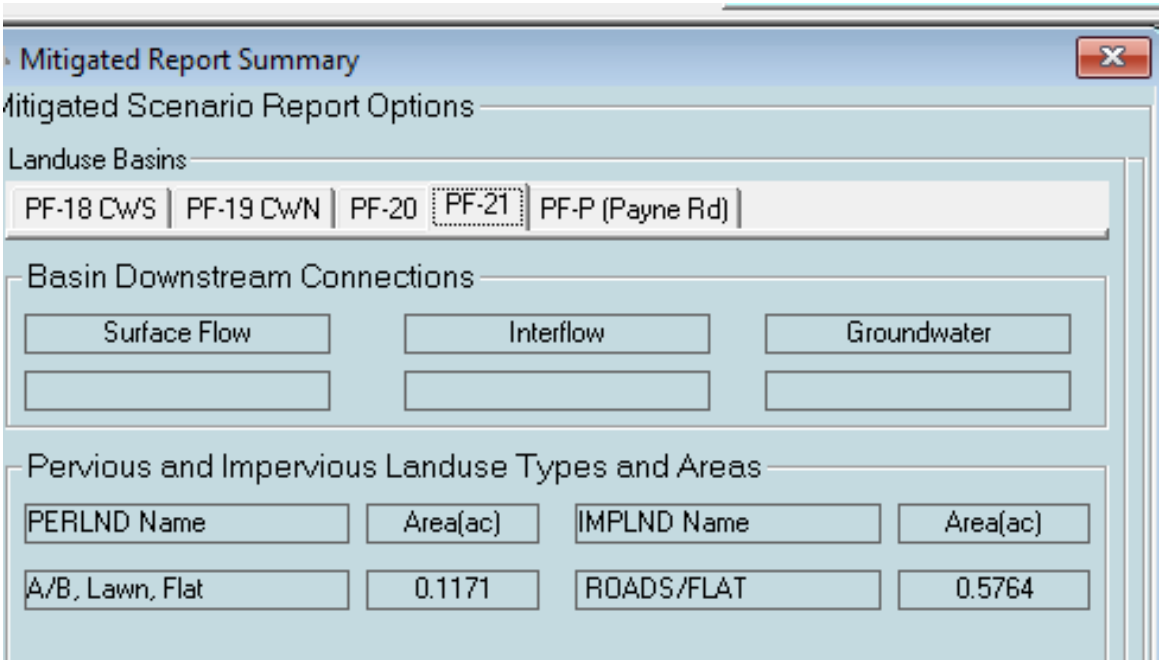


PF-20 WQ FLOW RATE

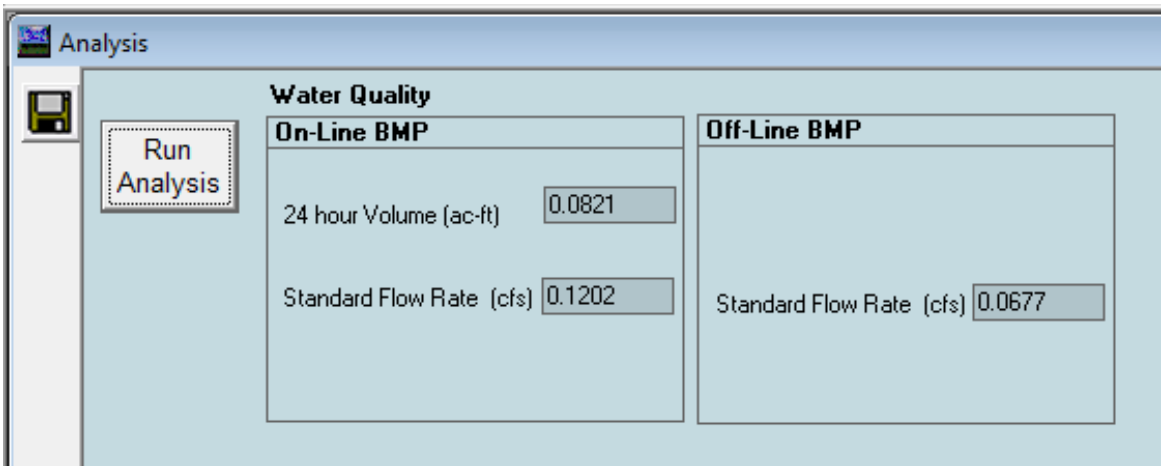


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-21 AREA (Camas Meadows Dr.)

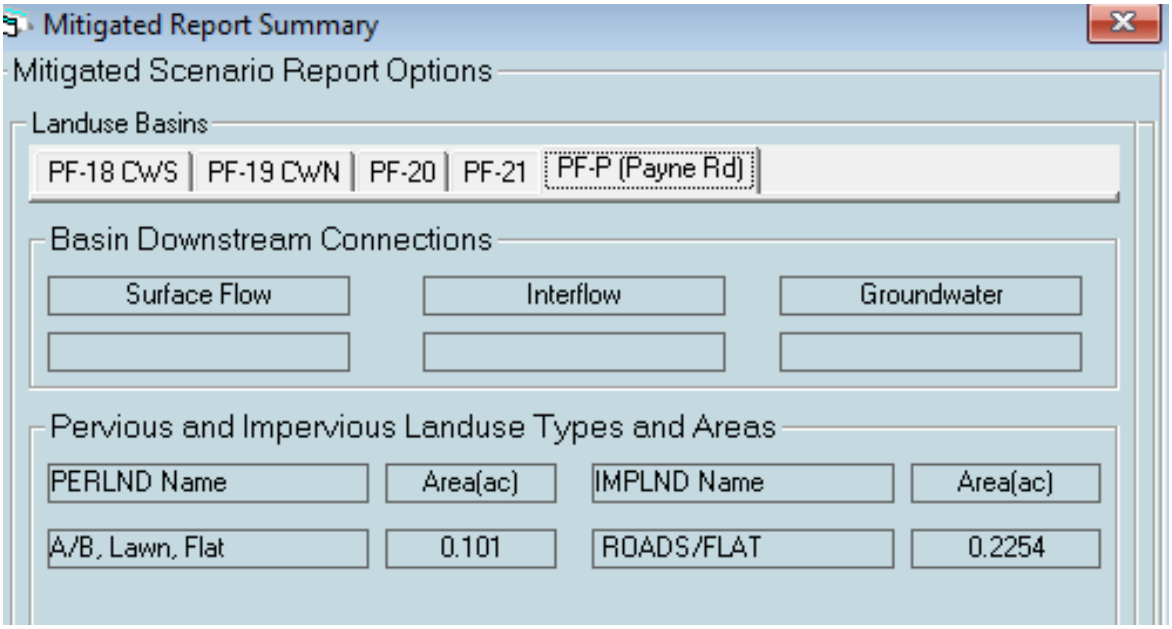


PF-21 WQ FLOW RATE

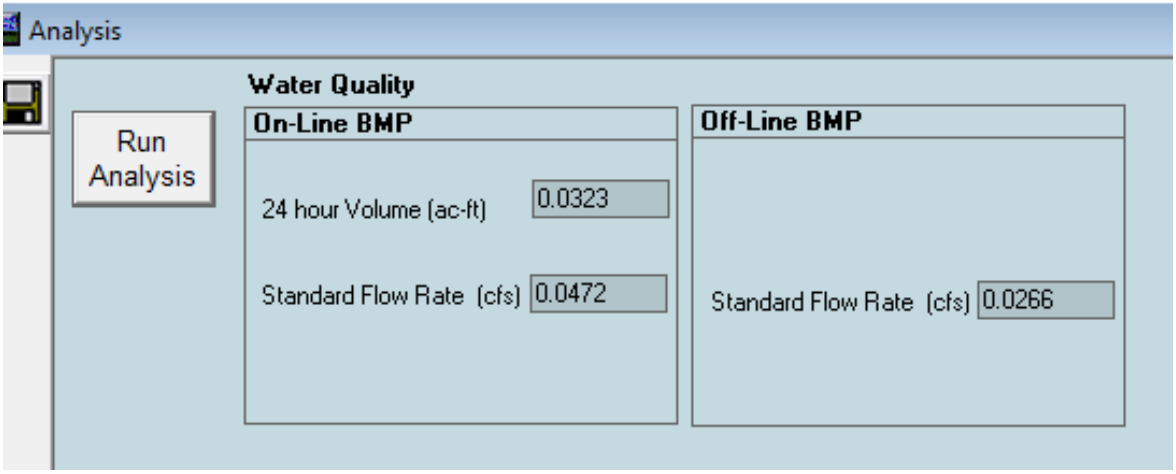


APPENDIX C-1 - WQ FLOW RATES FOR PERK FILTER SYSTEMS

PF-P AREA (Payne Rd)



PF-P WQ FLOW RATE (Payne Rd)



APPENDIX C-2 PERK FILTER SIZING SUMMARY
BASED ON WWHM WQ OFFLINE RATES

Perk Filter	ALLOWABLE CAPACITY - OFFLINE RATING			
Cartridge Size Height (in)	1 Unit Allowable Rate (cfs)	2 Unit Allowable Rate (cfs)	3 Unit Allowable Rate (cfs)	4 Unit Allowable Rate (cfs)
12"	0.015	0.030	0.045	0.061
18"	0.023	0.045	0.068	0.091
12" + 12"	0.030	0.061	0.091	0.121
18" + 12"	0.038	0.076	0.114	0.152

Parklands - System Requirements

Location	Perk Filter ID	Inflow Area Pervious (ac)	Inflow Area Impervious (ac)	Off-line Rate (cfs)	# Cartridge Bays	System	# Cartridges
Longbow - N	PF-1B	0.418	0.513	0.0610	4 Bi-lateral	12"	4-12"
Longbow - S	PF-2	0.339	0.385	0.0458	3 Bi-lateral	12"	3-12"
Longbow - W	PF-1A	0.186	0.1576	0.0188	1	18"	1-18"
Mc- NW	PF-3	0.044	0.314	0.0346	1	18" + 12"	1 - 18" and 1-12"
Mc - NE	PF-4	0.226	0.314	0.0370	3	12"	3-12"
Mc - S (LP)	PF-5	1.114	0.613	0.0799	3 Bi-lateral	12" + 12"	6-12"
Mc - mid- W	PF-6	0.365	0.144	0.0176	1	18"	1-18"
Mc - mid- E	PF-7	0.365	0.144	0.0176	1	18"	1-18"
Mc - S end-W	PF-8	0.434	0.1265	0.0221	1	18"	1-18"
Mc - S end-E	PF-9	0.434	0.1265	0.0221	1	18"	1-18"
Pittock	PF-15	0.232	0.455	0.0416	2	18"	2-18"

Camas Meadows Drive - System Requirements

Location	Perk Filter ID	Inflow Area Pervious (ac)	Inflow Area Impervious (ac)	Off-line Rate (cfs)	# Cartridge Bays	System	# Cartridges
E on N side CMD	PF-21	0.1171	0.5764	0.0677	3	18"	3-18"
E on S side CMD	PF-20	0.1624	0.4361	0.0514	2	12" + 12"	4-12"
W on S side CMD	PF-18	0.1848	0.5068	0.0597	2	12" + 12"	4-12"
W on N side CMD	PF-19	0.0887	0.4221	0.0496	2	12" + 12"	4-12"
Payne Rd.	PF-P	0.1010	0.2254	0.0266	1	12" + 12"	2-12"

Business Park - System Requirements

Location	Perk Filter ID	Inflow Area Pervious (ac)	Inflow Area Impervious (ac)	Off-line Rate (cfs)	# Cartridge Bays	System	# Cartridges
Bldg #1	PF-14	0.118	0.710	0.0834	3	12" + 12"	6-12"
Bldg #2	PF-13	0.100	0.510	0.0589	2	12" + 12"	4-12"
Bldg #3	PF-12	0.244	0.9225	0.1086	3 Bi-lateral	18" + 12"	3-12" & 3-18"
Bldg #4	PF-11	0.112	0.8355	0.0982	3	18" + 12"	3-12" & 3-18"
Bldg #4	PF-10	0.112	0.8355	0.0982	3	18" + 12"	3-12" & 3-18"

LPW	PF-16	0.031	0.452	0.0530	2	12" + 12"	4-12"
LPE	PF-17	0.017	0.523	0.0613	2	12" + 12"	4-12"

APPENDIX C3 WATER QUALITY
C-3a PHOSPHORUS LOADING ANALYSIS
DETERMINE PERCENT PHOSPHORUS REMOVAL BASED ON AREAS

SUMMARY OF CONTRIBUTING AREAS - SEE APPENDIX D SUBBASIN AREAS				
Contributing Area Description	**Treatment Condition**	**Area (ac)**	**Area/Total Area (ratio)**	**Percent**
Lawn and drives to buffer	No Perk Filter	4.527	0.1592	15.92%
Roofs to storm	No Perk Filter	3.753	0.1320	13.20%
Roofs to buffer	No Perk Filter	4.277	0.1504	15.04%
Treated Area	to Perk Filter	15.881	0.5584	55.84%
	Total for Site*	28.438		100.0%

*includes Camas Meadows Dr. and portion of Payne Rd.

Assume buffers/wetlands will remove 40% Phosphorous Pollutant Load - Evalaute 3 Scenarios

Scenario #1: Determine Percent Removal For Site Runoff - portion to Perk Filters and to buffer

Perk Filter	15.881	62.4% per TAPE		15.881*.624	9.91
No Perk Filter	4.527	**Lawn and drives to buffer**	assume average 40%	4.760*.40	1.81
Area of concern	20.408	All Roofs assumed "clean"			11.72
			percent removal	11.72/20.408	57.4%
					exceeds 50%

Scenario #2: Determine Percent Removal For Site Runoff - portion to Perk Filters and to buffer

Perk Filter	15.881	62.4% per TAPE		15.881*.624	9.91
No Perk Filter	8.804	**Lawn,drives, roofs to buffer**	assume average 40%	8.804*.40	3.52
	24.685	Roofs to storm assumed "clean" at 3.753 ac.			13.43
			percent removal	13.43/24.685	54.4%
					exceeds 50%

Scenario #3: Determine Percent Removal For Site Runoff - portion to Perk Filters and to buffer

Perk Filter	15.881	62.4% per TAPE		16.543*.624	9.91
No Perk Filter	12.557	**Lawn, roofs, and roofs to storm**	assume average 40%	11.027*.40	5.02
	28.438	include all areas			14.93
			percent removal	14.93/28.438	52.5%
					exceeds 50%

APPENDIX C3 WATER QUALITY
C-3a PHOSPHORUS LOADING ANALYSIS
DETERMINE PERCENT PHOSPHORUS REMOVAL BASED ON AREAS

SUMMARY OF CONTRIBUTING AREAS - SEE APPENDIX D SUBBASIN AREAS				
Contributing Area Description	**Treatment Condition**	**Area (ac)**	**Area/Total Area (ratio)**	**Percent**
Lawn and drives to buffer	No Perk Filter	4.527	0.1592	15.92%
Roofs to storm	No Perk Filter	3.753	0.1320	13.20%
Roofs to buffer	No Perk Filter	4.277	0.1504	15.04%
Treated Area	to Perk Filter	15.881	0.5584	55.84%
	Total for Site*	28.438		100.0%

*includes Camas Meadows Dr. and portion of Payne Rd.

Determine Minimum Percent Removal For Buffer to Satisfy 50% removal					
	Find for 50% removal - Scenario #1		by trial and error	10.204/20.408	50.0%
	4.527 + 15.881 = 20.408				
No Perk Filter	**4.527**	**Lawn and drives to buffer**	**6.5%**	4.527*0.065	0.294
and	15.881 + 4.277 + 3.753 = 23.911 acres considered "clean"			62.4 % portion	9.91
	All Roofs assumed "clean"				10.204
	Find for 50% removal - Scenario #2		by trial and error	12.3425/24.685	50.0%
	4.527 + 4.277 + 15.881 = 24.685		lowest level removal		
No Perk Filter	**8.804**		**27.63%**	8.804*.2763	2.4325
and	15.881 + 3.753 = 19.634 acres considered "clean"			62.4 % portion	9.91
	Roofs to storm assumed "clean", Roofs to buffers not assumed 'clean'				12.3422
	Find for 50% removal - Scenario #3		by trial and error	14.219/28.438	50.0%
	4.527 + 4.277 + 3.753 + 15.881 = 28.438		lowest level removal		
No Perk Filter	**12.557**		**34.3%**	12.557*.343	4.309
and	only 15.881 acres considered "clean"			62.4 % portion	9.91
					14.219

Notes:

1. The roof portion that goes directly to the storm system and not to the buffer is 2.835 Acres (McMaster, Longbow, and Pittock) and the roof portion from the south building (business) at 0.71 acres. This total of 3.55 acres is released at the two culverts betv Wetland A and B. This amount of runoff is assumed to be treated in the natural wetland ponding area - about 3.37 acre surface area. The most direct flow path through the onsite wetland is about 550 LF and then passes over another 600 LF in a shallow flo path through mostly reed canary grass. Reed canary grass is considered an excellent treatment medium.

2. The roof areas from the other three business portions (1.03 acres) will be released to the storm system and then released fror the dissipation system to the buffer (304 ft spread for sheet flow).

APPENDIX C WATER QUALITY
C-3b PHOSPHORUS LOADING CALCULATIONS

Reference : Pennsylvania Stormwater Best Management Practices Manaual
Chapter 8, Worksheet 12 (attached)

PREDEVELOPMENT AREA AND POLLUTANT LOADING				
Pre	28.437	0.30	2.7	**23.03**

Note: 0.3 is factor for HSG C soil (silt loam, clay loam or silty clay loam)

Developed - Untreated Portion to Buffer or to Wetlands				
Source	**Surface Area (ac)**	**TP EMC (mg/l)**	**Unit Conversion Factor**	**Pollutant Load**
Lots 2-10 - roofs	1.045	0.13	2.7	0.367 LBS
Lots 11-15 - roofs	0.597	0.13	2.7	0.210 LBS
Lot 16 - roof	0.149	0.13	2.7	0.052 LBS
Lots 32-38 - roofs	1.067	0.13	2.7	0.375 LBS
Lots 39-40 - roofs	0.298	0.13	2.7	0.105 LBS
Lots 41-42 - roofs	0.298	0.13	2.7	0.105 LBS
Business - roofs	4.575	0.13	2.7	1.606 LBS
Lots 2-10 - lawn/drive	0.989	0.40	2.7	1.068 LBS
Lots 11-15 - lawn/drive	1.795	0.40	2.7	1.939 LBS
Lot 16 - lawn/drive	0.213	0.40	2.7	0.230 LBS
Lots 32-38 - lawn/drive	0.731	0.40	2.7	0.789 LBS
Lots 39-40 - lawn/drive	0.311	0.40	2.7	0.336 LBS
Lots 41-42 - lawn/drive	0.218	0.40	2.7	0.235 LBS
north of parking lot	0.27	0.40	2.7	0.292 LBS
	12.556			**7.707 LBS**

Source	**Surface Area (ac)**	**TP EMC (mg/l)**	**Unit Conversion Factor**	**Pollutant Load**	
CMD	2.763	0.33	2.7	2.462 LBS	treated
Pittock	0.585	0.36	2.7	0.569 LBS	treated
Business -east	2.832	0.39	2.7	2.982 LBS	treated
Business -west	2.890	0.39	2.7	3.043 LBS	treated
Lawn to streeet	3.652	0.40	2.7	3.944 LBS	treated
Streets - R/W	3.159	0.36	2.7	3.071 LBS	treated
	15.881			**16.070 LBS**	
				7.707 LBS	
Total Post-Development Load				**23.778 LBS**	

Total Area 28.437

APPENDIX C WATER QUALITY
C-3b PHOSPHORUS LOADING CALCULATIONS

DETERMINE POLLUTANT LOADING WITH TREATMENT ACCOUNTED FOR		
16.07 lbs treated at 62.4% = 9.91 lbs removed	6.160 lbs remain	
6.495 lbs treated at 45%* = 2.923 lbs removed	3.572 lbs remain	
Pollutant Load	9.73 LBS	OK
compare Pre loading	23.03 LBS	

Note that even witout treatment credit at buffer, 6.16 + 6.495 = 12.655 LBS
which is a 45% reduction from Pre loading. So buffere only needs to provide 5% redu

*Assume wetland buffer will treat 45% of phosphorus pollutant load
1. Literature search varies on removal percentages.
However, natural buffers are considered effective even for wastewater conditions.
2. Buffer widths for 0% to 8% slopes are generally listed n the 70 to 100 LF range.
The buffer width for this site is 50 LF. However, during the WQ event, the distance to ponded water in the wetland is more than 50 feet. See attachment with contour 188 for reference.

Exhibit 16 SP26-1005

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: _____

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	

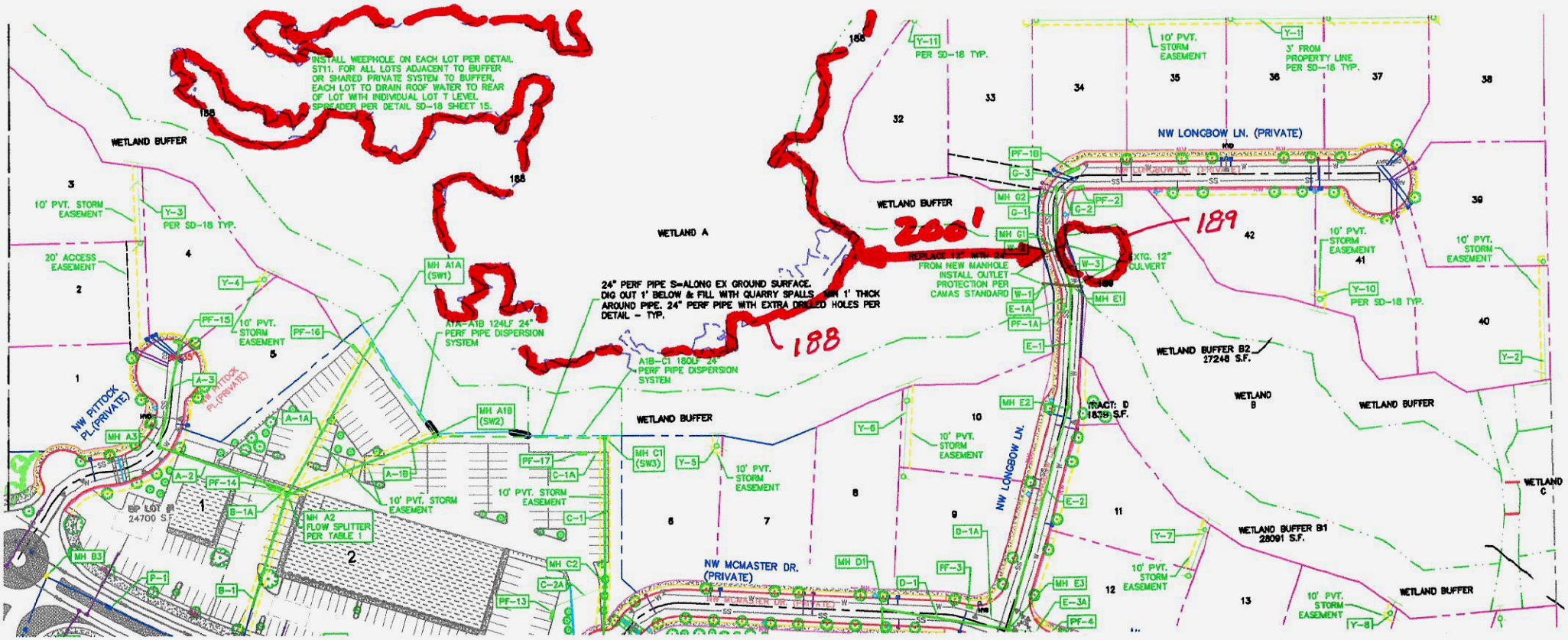
DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

		POLLUTANT					POLLUTANT LOAD**		
	LAND COVER CLASSIFICATION	TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*	COVER (Acres)	RUNOFF VOLUME (AF)	TSS*** (LBS)	TP*** (LBS)	NO_3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17					
	Meadow	47	0.19	0.3					
	Fertilized Planting Area	55	1.34	0.73					
	Native Planting Area	55	0.40	0.33					
	Lawn, Low-Input	180	0.40	0.44					
	Lawn, High-Input	180	2.22	1.46					
	Golf Course Fairway/Green	305	1.07	1.84					
	Grassed Athletic Field	200	1.07	1.01					
Impervious Surfaces	Rooftop	21	0.13	0.32					
	High Traffic Street / Highway	261	0.40	0.83					
	Medium Traffic Street	113	0.33	0.58					
	Low Traffic / Residential Street	86	0.36	0.47					
	Res. Driveway, Play Courts, etc.	60	0.46	0.47					
	High Traffic Parking Lot	120	0.39	0.60					
	Low Traffic Parking Lot	58	0.15	0.39					
						TOTAL LOAD TO THIS BMP TYPE			
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE 9-3 (%)			
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)			

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)			
REQUIRED REDUCTION FROM WS12 (LBS)			

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area



Release at Longbow Ln.
The flow will travel about 200 LF prior to reaching the ponded water area with a flow path that continues to the north property line and enters dense reed canary grass.

Wetland A
The flow path for phosphorus treatment is the 50 LF buffer width plus flow to the 188 contour (actually to about 187.7)

Wetland B
The flow path for phosphorus treatment is the 50 LF buffer width plus flow to the 189 contour near the culvert.

APPENDIX D

Storm System Elements Discussion - Brief

The main piping has been entered into the model as Storm Line A, B, C, D, E, F, and G. The majority of the effort has been to make sure that the subbasin areas have been accounted for and directed to the appropriate storm system. The subbasin areas have been tabulated with respect to pervious and impervious area.

The plan shows the location of the Perk Filter system units and the outfall for Storm Line B and C in particular. These two outfalls will utilize stilling well structures to dissipate the energy from for flow from nearly 20 acres for each system. The Line A system is actually providing two stilling well structures. This second structure is mainly for better distribution of the flow volume to the perforated pipe dissipation system. See Appendix E-3 and E-4.

Appendix D Conveyance System

D-1 Storm System Pipe Capacity and Velocity Check -10-yr (Reach Info and HGL)

Reach Analysis
HCAD for Line A and B – 10-yr
HCAD for Line C – 10-yr
HCAD for Line E – 10-yr
HCAD for Line D, E, and F – 10-yr
HCAD for Line G
HCAD Thru Wetlands – 10-yr
HGL analysis
HCAD for Line A and B – 10-yr
HCAD for Line C – 10-yr
HCAD for Line D, E, and F – 10-yr
HCAD for Line G

D-2 Conveyance Design Comments

D-3 Dynamic Analysis Water Surface Summary for 100-yr Surcharged Condition

HCAD for Line A, B, and C – 100-yr
HCAD for Line E
HCAD for Line D and F – 100-yr
HCAD for Line G
HCAD Thru Wetlands – 100-yr

D-4 Rear Yard Sytems

HCAD for Rear Yard Systems – see also App. C-4 WQ for Single Lot

APPENDIX D
D-1 SUBBASIN AREAS-SITE AND CAMAS MEADOWS DRIVE

SUMMARY OF DRAINAGE AREAS

AREAS TREATED WITH PERK FILTERS FOR PHOSPHORUS

MCMASTER DR. AND LONGBOW LN TO WETLAND A - SOUTH CULVERT*

Subcat ID	Drive Area (sf)	Lawn Area (sf)	Street Area (sf)	Sidewalk Area (sf)	Grass Area (sf)	Total Area (sf)	Total Area (ac)
PF1A	1,000	7,576	3,978	1,884	529	14,967	0.344
PF3	---	---	9,509	3,282	1,856	14,647	0.336
PF4	2,000	7,966	8,740	2,939	1,901	23,546	0.541
PF5	5,000	44,399	15,809	5,894	4,136	75,238	1.727
PF6	2,360	15,391	2,900	1,000	540	22,191	0.509
PF7	2,360	15,329	2,900	1,000	540	22,129	0.508
PF8	3,000	18,452	1,923	586	176	24,137	0.554
PF9	3,000	18,452	1,923	586	176	24,137	0.554
	18,720	127,565	47,682	17,171	9,854	220,992	**5.073**
	0.430 Ac.	**2.928 Ac.**	1.095 Ac.	0.394 Ac.	0.226 Ac.		

LONGBOW LN TO WETLAND A - NORTH CULVERT*

Subcat ID	Drive Area (sf)	Lawn Area (sf)	Street Area (sf)	Sidewalk Area (sf)	Grass Area (sf)	Total Area (sf)	Total Area (ac)
PF1B	6,500	18,000	10,791	5,080	3,227	43,598	1.001
PF2	5,000	13,500	11,731	545	1,285	32,061	0.736
	11,500.00	31,500.00	22,522.00	5,625.00	4,512.00	75,659	**1.737**
	0.264 Ac.	**0.723 Ac.**	0.517 Ac.	0.129 Ac.	0.104 Ac.		

* North and South Culverts are now Interconnected

SUMMARY FOR TREATED AREAS -MCMASTER AND LONGBOW SYSTEM

Drive Area (sf)	Lawn Area (sf)	Street Area (sf)	Sidewalk Area (sf)	Grass Area (sf)	Total Area (sf)	Total Area (ac)
30,220	159,065	70,204	22,796	14,366	296,651	**6.810**
0.694 Ac.	3.652 Ac.	1.612 Ac.	0.523 Ac.	0.330 Ac.		

SUMMARY FOR TREATED AREAS - BUSINESS PK -EAST

Subcat ID	Parking Area (sf)	Landscape Area (sf)	Total Area (sf)	Total Area (ac)
PF10	37,875	6,109	43,984	1.010
PF11	35,023	3,662	38,685	0.888
PF12	30,681	9,998	40,679	0.934
	103,579	19,769	123,348	**2.832**
	2.378 Ac.	0.454 Ac.		

APPENDIX D
D-1 SUBBASIN AREAS-SITE AND CAMAS MEADOWS DRIVE

SUMMARY FOR TREATED AREAS - BUSINESS PK -WEST				
Subcat ID	**Parking Area (sf)**	**Landscape Area (sf)**	**Total Area (sf)**	**Total Area (ac)**
PF13	21,016	4,369	25,385	0.583
PF14	33,428	5,160	38,588	0.886
PF16	19,881	1,364	21,245	0.488
PF17	30,681	9,998	40,679	0.934
	105,006	20,891	125,897	**2.890**
	2.411 Ac.	0.480 Ac.		

PITTOCK PLACE							
Subcat ID	**Drive Area (sf)**	**Lawn Area (sf)**	**Street Area (sf)**	**Sidewalk Area (sf)**	**Grass Area (sf)**	**Total Area (sf)**	**Total Area (ac)**
PF15	1,000	9,010	13,447	1,350	683	25,490	**0.585**

Camas Meadows Drive and Payne Rd (portion)

Subcat ID	**Street Area (sf)**	**Sidewalk Area (sf)**	**Grass Area (sf)**	**Total Area (sf)**	**Total Area (ac)**
PFP	7,418	2,400	4,400	14,218	0.326
PF18	17,676	4,400	8,052	30,128	0.692
PF19	13,067	5,420	3,864	22,351	0.513
PF20	15,139	3,858	7,073	26,070	0.598
PF21	15,214	7,280	5,100	27,594	0.633
	68,514	23,358	28,489	120,361	**2.763**

SUMMARY FOR TREATED AREAS	
McMaster and Longbow Ln	6.810
Business Park-East	2.832
Business Park-West	2.890
Pittock Place	0.585
Camas Meadows Drive	2.763
	15.880

Treated

APPENDIX D
D-1 SUBBASIN AREAS-SITE AND CAMAS MEADOWS DRIVE

UNTREATED - DRAINS TO AND THROUGH BUFFER

South of Wetland A			W1A and W1B		
Lot #	**Lot Area (sf)**	**Roof (sf)**	**Drive (sf)**	**Lawn (sf)**	
2	16,255	6,500	1,000	8,755	Note: Lot # 1 drains to Pittock Place
3	18,071	6,500	1,000	10,571	
4	16,016	6,500	1,000	8,516	
5	15,864	---	1,000	8,364	Lot #5 roof drains to Pittock Place
6	16,213	6,500	1,000	8,713	
7	15,463	6,500	1,000	7,963	
8	17,274	6,500	1,000	9,774	
9	---	---	---	---	Note: Lot # 9 drains to Longbow Ln. -See PF1A
10	15,043	6,500	1,000	7,543	
	130,199	45,500	8,000	70,199	
	2.989 Ac.	1.045 Ac.	0.184 Ac.	1.612 Ac.	

Imperv.	Perv.	Total
1.228 Ac.	1.612 Ac.	2.840 Ac.

Lawn/Drive
1.795 Ac.

Subcat ID		Lawn (sf)
LPD	North of parking area	11,678

0.27 Ac.

Lots South of Wetland B					
Lot #	**Lot Area (sf)**	**Roof (sf)**	**Drive (sf)**	**Lawn (sf)**	
11	15,008	6,500	1,000	7,508	
12	15,090	---	1,000	7,590	Note: Lot #12 roof to drains to Longbow Ln. - See PF2
13	15,073	6,500	1,000	7,573	
14	15,016	6,500	1,000	7,516	
15	15,413	6,500	1,000	7,913	
	75,600	26,000	5,000	38,100	
	1.736 Ac.	0.597 Ac.	0.115 Ac.	0.875 Ac.	

Imperv.	Perv.	Total
0.712 Ac.	0.875 Ac.	1.586 Ac.

Lawn/Drive
0.989 Ac.

E1A	E1B
0.689	0.875

Lots South of Wetland C					
Lot #	**Lot Area (sf)**	**Roof (sf)**	**Drive (sf)**	**Lawn (sf)**	
16	15,798	6,500	1,000	8,298	
	0.363 Ac.	0.149 Ac.	0.023 Ac.	0.190 Ac.	

Imperv.	Perv.	Total
0.172 Ac.	0.190 Ac.	0.363 Ac.

Lawn/Drive
0.213 Ac.

E2A	E2B

APPENDIX D
D-1 SUBBASIN AREAS-SITE AND CAMAS MEADOWS DRIVE

Lot #	Lot Area (sf)	Roof (sf)	Lawn (sf)
32	15,328	7,500	7,828
33	16,516	6,500	6,016
34	15,112	6,500	4,612
35	15,103	6,500	4,603
36	15,096	6,500	4,596
37	15,473	6,500	4,973
38	18,044	6,500	7,044
	110,672	46,500	39,672
	2.541 Ac.	1.067 Ac.	0.731 Ac.

Imperv.	Perv.	Total
1.067 Ac.	0.731 Ac.	1.799 Ac.
N1A	**N1B**	

Lots North of Wetland B Portion Draining to Rear			
Lot #	**Lot Area (sf)**	**Roof (sf)**	**Lawn (sf)**
39	18,235	6,500	6,235
40	18,329	6,500	7,329
	36,564	13,000	13,564
	0.839 Ac.	**0.298 Ac.**	**0.311**
		N2A	**N2B**

Lots North of Wetland B Portion Draining to Longbow Ln.			
Lot #	**Lot Area (sf)**	**Drives (sf)**	**Lawn (sf)**
39	18,235	1,000	7,500
40	18,329	1,500	3,000
	36,564	2,500	10,500
	0.839 Ac.	0.057 Ac.	0.241 Ac.
			Drains to PF2

Lots North of Wetland B Portion Draining to Rear			
Lot #	**Lot Area (sf)**	**Roof (sf)**	**Lawn (sf)**
42	15,385	6,500	4,885
41	15,115	6,500	4,615
	30,500	13,000	9,500
	0.700 Ac.	**0.298 Ac.**	**0.218**
		N3A	**N3B**

Lots North of Wetland B Portion Draining toLongbow Ln.			
Lot #	**Lot Area (sf)**	**Drives (sf)**	**Lawn (sf)**
42	15,385	1,000	3,000
41	15,115	1,000	3,000
	30,500	2,000	6,000
	0.700 Ac.	0.046 Ac.	0.138 Ac.
			Drains to PF2

Roof Areas Released at Longbow Ln. - Untreated

System - Untreated

Roof Areas to McMaster Dr. and Longbow Ln - Line E			
Subcat ID	**# Roofs**	**Roof Area (sf)**	**Total Area (ac)**
RE2	2	13,000	0.298
RE3A	1	6,500	0.149
RE3B	2	13,000	0.298
RE4	1	6,500	0.149
RE5	1	6,500	0.149
RE6	4	26,000	0.597
RE7	2	13,000	0.298
RE8	2	13,000	0.298
RE9	1	6,500	0.149
	16	104,000	**2.388**

Roof Areas to Pittock Place.			
Subcat ID	**# Roofs**	**Roof Area (sf)**	**Total Area (ac)**
RP1	2	13,000	0.298

Business Park Roof Areas to Dissipation System			
Subcat ID	**# Roofs**	**Roof Area (sf)**	**Total Area (ac)**
BPR1	Business	3,000	0.069
BPR2	Business	19857	0.456
			0.525

Total roof area not treated	**0.823**
Total line D, E, & F	**3.753**

APPENDIX D
D-1 SUBBASIN AREAS-SITE AND CAMAS MEADOWS DRIVE

Roof Areas to McMaster Dr. - Line D and F			
Subcat ID	**# Roofs**	**Roof Area (sf)**	**Total Area (ac)**
RD1	1	6,500	0.149
		6,500	**0.149**

Roof Areas to McMaster Dr. - Line D and F			
Subcat ID	**# Roofs**	**Roof Area (sf)**	**Total Area (ac)**
BPR3	Business	21950	0.504
BPR4	Business	31,000	0.712
			1.216

Total roof area not treated **3.7530** roofs to storm and Wetland A

Sum Total - not treated	**4.576**
Lots 2-10	1.045
Lots 11-15	0.597
Lot 16	0.149
Lots 32-38	1.067
Lots 39-40	0.298
Lots 41-42	0.298
	3.454
to dissipation system and buffer	0.823
	4.277

Impervious Area (ac)	Pervious Area (ac)		
1.228	1.612		
	0.27		
0.689 Ac.	0.875 Ac.		
0.172	0.19		
1.067	0.731		
0.298	0.311		
0.298	0.218		
3.752	4.207	7.959	Untreated (Imperv. and Perv.)
		4.575	Untreated - roofs
		15.881	Treated
	Total	########	

compare 28.14 Ac. in HCAD

SUMMARY FOR POLLUTANT ANALYSIS		
Contributing Area Description	**Treatment Condition**	**Area (ac)**
Lawn and drives to buffer	No Perk Filter	4.527
Roofs to storm	No Perk Filter	3.753
Roofs to buffer	No Perk Filter	4.277
Treated Area	to Perk Filter	15.881
	Total for Site*	28.438

*includes Camas Meadows Dr. and portion of Payne Rd.

Note: slight descrepancies in area summaries - insignificant

APPENDIX D CONVEYANCE SYSTEM
D-1 STORM SYSTEM PIPE CAPACITY
AND VELOCITY CHECK - 10-YR EVENT

Notes:
1. The storm systems are sized for open channel flow - 10-yr event. However, velocity head losses create a backwater condition -see remark column.
2. In the 10-yr max. velocity column, the open channel flow velocity is noted first and then the velocity due to the backwater condition where applicable.

STORM LINE A & B

Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. Velocity at 10-yr Flow (fps)*	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
PF-P1	MH P1	PFP1	9.0	10	230.28	229.07	229.02	0.0056	0.27	1.63	2.21/1.97	229.40	0.33	0.83	OK
MH P1	MH B3	P-2	116.7	12	230.46	229.02	222.58	0.0552	0.27	8.40	4.86/1.71	229.27	0.25	1.00	OK
MH B3	MH B1	P-1	222.6	12	230.25	222.38	214.85	0.0338	0.27	6.56	4.09/1.71	222.63	0.25	1.00	OK
PF-18	MH B2	PF18	30.0	10	221.73	216.64	215.69	0.0317	0.50	4.04	5.04/2.69	217.05	0.41	0.83	OK
PF-19	MH B2	PF19	30.0	10	221.73	216.64	215.69	0.0317	0.39	4.04	4.69/2.43	217.01	0.37	0.83	OK
MH B2	MH B1	B-2	67.9	12	222.11	215.49	214.85	0.0094	0.89	3.48	3.71/1.03	216.72	1.23	1.00	submerged
MH B4	MH B1	B-4	61.5	18	229.98	215.67	214.85	0.0133	3.19	12.13	5.79/2.80	216.94	1.27	1.50	submerged
MH B1	MH A2	B-1	190.0	18	222.45	214.65	211.10	0.0187	9.53	14.4	8.71/5.40	216.66	2.01	1.50	submerged
PF-15	MH A3	A-3	112.6	10	205.36	201.36	200.80	0.0050	0.72	1.55	2.78/2.65	201.91	0.55	0.83	OK
MH A3	MH A2	A-2	253.0	10	218.14	200.73	199.47	0.0050	0.72	1.94	3.30/2.11	201.26	0.53	0.83	submerged
MH A2	MH A1A	A-1A	184.0	15	218.95	199.37	188.00	0.0618	5.71	16.06	13.09/4.65	200.83	1.46	1.25	submerged
MH A2	MHA1B	A-1B	170.0	15	218.95	199.37	188.50	0.0639	5.71	16.33	13.31/4.65	200.83	1.46	1.25	submerged
MH A1B	MH C1	A1B-C1	180.0	24	200.70	191.50	192.00	-0.0028	28.77	11.97	---/3.81	192.53	1.03	2.00	OK
MH A1A	MH A1B	AIA-A1B	124.0	24	200.00	191.00	191.50	-0.0040	28.77	14.31	---/4.55	192.53	1.53	2.00	OK
PF-14	MH A2	B-1A	10.0	8	217.63	212.80	212.72	0.0080	0.73	1.08	3.33/2.8	213.42	0.62	0.67	OK
PF-16	MH A1A	A-1C	9.5	8	200.56	195.73	189.67	0.6379	0.42	9.65	13.86/2.09	196.11	0.38	0.67	OK

Storm System Line C

Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. Velocity at 10-yr Flow (fps)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
D1-1	Tee into C-10	C-11	13.0	15	243.08+/-	240.13	238.23	0.1462	no flow	24.7	---	no flow	---	---	---
Extg MH C11	MH C10	C-10	163.4	18	242.62	238.72	237.68	0.0064	2.46	8.38	4.12/3.3	239.68	0.96	1.50	OK
MH C10	MH C9	C-9	121.7	18	242.00	237.68	237.25	0.0035	2.46	6.24	3.32/2.45	239.13	1.45	1.50	OK
MH C9	MH C8	C-8	200.0	24	245.34	237.25	228.79	0.0423	13.2	46.53	12.75/4.51	239.01	1.76	2.00	OK
MH C8	MH C7	C-7	166.3	24	236.46	228.59	224.72	0.0233	13.19	34.51	10.25/4.51	230.35	1.76	2.00	OK
MH C7	MH C6	C-6	149.8	30	231.84	224.52	221.94	0.0172	13.19	53.83	9.06/4.89	226.28	1.76	2.50	OK
PF-20	MH C6	C6-B	21.0	8	230.19	225.19	223.57	0.0771	0.43	5.10	5.68/2.89	225.56	0.37	0.67	OK

APPENDIX D CONVEYANCE SYSTEM
D-1 STORM SYSTEM PIPE CAPACITY
AND VELOCITY CHECK - 10-YR EVENT

PF-21	MH C6	C-6A	21.0	8	230.19	225.19	223.57	0.0771	0.48	6.69	7.10/2.06	226.09	0.9	0.67	submerged
MH C6	MH C5	C-5	118.1	30	230.60	221.74	221.10	0.0054	14.11	30.19	6.04/2.51	225.31	3.57	2.50	submerged
MH C5	MH C4	C-4	96.4	30	231.17	220.90	220.41	0.0051	14.11	29.24	5.90/2.60	224.99	4.09	2.50	submerged
MH C4	MH C3	C-3	55.6	30	231.61	220.21	220.08	0.0023	16.08	19.83	4.5/3.13	224.66	4.45	2.50	submerged
MH C3	MH C2	C-2	134.0	18	228.35	219.88	201.00	0.1409	16.08	39.43	21.17/9.09	224.04	4.16	1.50	submerged
PF-13	MH C2	C-2A	63.5	8	216.70	211.87	206.00	0.0924	0.47	3.67	7.24/2.15	212.27	0.40	0.67	OK
MH C2	MH C1	C-1	158.5	18	210.80	200.80	189.00	0.0744	16.53	28.66	16.79/9.35	205.17	4.37	1.50	submerged
PF-17	MHC1	C-1A	16.4	8	203.88	199.05	190.22	0.5384	0.42	8.87	13.05/2.09	199.43	0.38	0.67	OK

Storm System Line D, E, & F

Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. Velocity at 10-yr Flow (fps)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
DI-2	Extg MH	E-12	15.0	15	224.78+/-	221.83	218.62	0.2140	no flow	29.88	---	no flow	---	1.25	no flow
Extg MH	AD4	E-11	14.0	12	221.88	218.62	217.00	0.1157	2.94	12.12	12.72/4.13	219.86	1.24	1.00	submerged
AD4	AD1	E-10	25.0	15	219.00	216.00	215.85	0.0060	2.94	7.37	5.66/3.73	217.11	1.11	1.25	OK
AD3	AD2	E-14	94.8	12	228.00	226.00	216.00	0.1055	GW flow ?	11.57	---	226.00	Min. Flow	1.00	OK
AD2	AD1	E-13	124.0	12	218.00	216.00	215.50	0.0040	0.13	2.26	1.58/0.57	216.46	0.46	1.00	OK
AD1	MH E9	E-9	115.3	15	218.00	215.50	214.00	0.0130	3.31	7.37	5.84/3.32	216.45	0.95	1.25	OK
MH E9	MH E8	E-8	76.5	15	219.24	214.00	213.00	0.0131	3.46	7.39	5.92/4.44	215.01	1.01	1.25	OK
MH E8	MH E7	E-7	84.3	15	217.50	213.00	212.35	0.0077	3.46	5.67	4.85/4.11	214.09	1.09	1.25	OK
PF-8	MH E7	E-7A	12.0	6	216.05	212.22	212.15	0.0058	0.32	0.85	2.27/0.73	213.33	1.11	0.50	submerged
PF-9	MH E7	E-7B	10.0	6	216.05	212.22	212.15	0.0070	0.32	0.94	2.43/0.73	213.33	1.11	0.50	submerged
MH E7	MH E6	E-6	196.3	15	216.29	212.15	210.35	0.0092	4.28	6.19	5.44/3.64	213.29	1.14	1.25	OK
PF-6	MH E6	PF5	12.0	6	214.04	210.79	210.15	0.0533	0.30	2.24	0.85/0.75	211.34	0.55	0.50	submerged
PF-7	MH E6	PF7	10.0	6	214.04	210.79	210.15	0.0640	0.30	2.39	0.94/0.75	211.34	0.55	0.50	submerged
MH E6	MH E5B	E-5B	93.4	18	214.32	210.15	209.00	0.0123	5.36	10.59	6.01/3.67	211.31	1.16	1.50	OK
MH E5B	MH E5A	E-5A	55.9	18	213.36	208.80	208.10	0.0125	5.48	27.39	12.10/4.94	210.00	1.20	1.50	OK
MH E5A	MH E4	E-4	173.9	18	212.78	207.90	205.20	0.0155	5.6	20.63	9.93/3.73	209.09	1.19	1.50	OK
PF-10	MH F1	F-2R	85.6	10	226.48	220.90	215.55	0.0625	0.84	5.48	7.27/2.42	221.41	0.51	0.83	OK

APPENDIX D CONVEYANCE SYSTEM
D-1 STORM SYSTEM PIPE CAPACITY
AND VELOCITY CHECK - 10-YR EVENT

PF-11	MH F1	F-2L	125.6	10	226.26	220.68	215.55	0.0408	0.76	4.43	6.06/2.35	221.16	0.48	0.83	OK
MH F1	MH E4	F-1	180.7	12	219.53	215.45	205.29	0.0562	2.48	8.45	9.34/3.27	216.37	0.92	1.00	OK
MH E4	MH E3	E-3	213.4	18	209.38	205.00	198.29	0.0314	8.13	18.63	10.18/4.62	206.66	1.66	1.50	submerged
PF-3	MH E3	D-1A	17.0	8	203.47	200.05	198.84	0.0712	0.28	0.83	2.14	200.66	0.61	0.67	OK
PF-4	MH E3	E-3A	10.0	8	203.56	200.14	199.71	0.0430	0.38	0.85	2.37/0.33	200.68	0.54	0.67	OK
PF-5	MH E3	D-1B	13.0	8	203.20	198.41	198.29	0.0092	1.05	1.16	3.77/3.04	201.02	2.61	0.67	submerged
PF-12	MH D2	D-2	138.0	10	215.79	215.79	200.64	0.1098	1.31	7.26	10.08/2.78	216.46	0.67	0.83	
MH D2	MH E3	D-1	135.8	12	204.67	200.00	198.29	0.0126	1.31	4.00	4.55/2.14	200.96	0.96	1.00	OK
MH E3	MH E2	E-2	244.9	18	203.49	198.09	190.20	0.0322	11.33	18.85	11.15/6.45	200.61	2.52	1.50	submerged
MH E2	MH E1	E-1	129.1	18	193.30	190.00	187.98	0.0156	11.33	13.14	8.36/6.45	192.54	2.54	1.50	submerged
PF-1A	MH E1	E-1A	26.0	8	191.94	188.52	187.47	0.0404	0.23	2.43	4.36/1.00	189.04	0.52	0.67	OK
MH E1	OUTLET	W-1	30.0	24	190.86	187.47	187.47	0.0000	6.72	---	---/3.65	188.99	1.52	2.00	OK
MH E1	MH G1	W-3	43.0	24	190.86	187.98	186.07	0.0444	4.85	47.67	15.17/4.45	189.99	2.01	2.00	submerged

Storm System Line G

Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. Velocity at 10-yr Flow (fps)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
PF-1B	MH G2	G-3	19.0	6	189.75	186.5	186.34	0.0084	0.68	0.51	2.62/3.37	188.92	2.42	0.50	submerged
PF-2	MH G2	G-2	18.0	6	189.66	186.41	186.34	0.0039	0.51	0.35	1.79/2.48	188.68	2.27	0.50	submerged
MH G2	MH G1	G-1	63.8	12	189.88	186.34	186.07	0.0042	1.18	2.32	2.76/1.34	188.40	2.06	1.00	submerged
MH G1	OUTLET	W-2	14.7	24	190.37	186.07	186.06	0.0007	7.84	5.99	1.91/2.45	188.32	2.25	2.00	submerged

APPENDIX D-1
PIPE CAPACITY CALCS

Note: Pipes modeled with Pond symbol in HCAD do not provide pipe capacity - but do provide pipe

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: MH A2 to MH A1A or Line A-1A

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter = 15 in. = or 1.25 feet

Pipe slope = 0.0618 ft. per foot

Manning's n = 0.013

Pipe cross-section area $A = \pi r^2$ = 1.227 sq. ft.

Pipe hydraulic radius R = D/4 = 0.3125

$K = 1.486/n((AR^{2/3})$ K 64.595

Then Q = 16.059 cfs 7207.68 gpm
V = 13.086 fps

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: MH A2 to MH A1B (A-1B)

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter = 15 in. = or 1.25 feet

Pipe slope = 0.0639 ft. per foot

Manning's n = 0.013

Pipe cross-section area $A = \pi r^2$ = 1.227 sq. ft.

Pipe hydraulic radius R = D/4 = 0.3125

$K = 1.486/n((AR^{2/3})$ K 64.595

Then Q = 16.329 cfs 7329.12 gpm
V = 13.306 fps

APPENDIX D-1
PIPE CAPACITY CALCS

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: Stub to MH C9from south

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter =	24	in. = or	2 feet
Pipe slope =	0.0423	ft. per foot	
Manning's n =	0.013		
Pipe cross-section area	A = π r^2 =	3.142 sq. ft.	
Pipe hydraulic radius	R = D/4 =	0.5000	
K = 1.486/n((AR$^{2/3}$)	K	226.219	
Then	Q =	46.527 cfs	20882.94 gpm
	V =	14.810 fps	

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: MH C4 to MH C3 (Line C-3)

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter =	30	in. = or	2.5 feet
Pipe slope =	0.0023	ft. per foot	
Manning's n =	0.013		
Pipe cross-section area	A = π r^2 =	4.909 sq. ft.	
Pipe hydraulic radius	R = D/4 =	0.6250	
K = 1.486/n((AR$^{2/3}$)	K	410.165	
Then	Q =	19.671 cfs	8829.01 gpm
	V =	4.007 fps	

APPENDIX D-1
PIPE CAPACITY CALCS

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: MH E4 to MH E3 Line E-3)

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter =	18	in. = or	1.5 feet
Pipe slope =	0.0314	ft. per foot	
Manning's n =	0.013		
Pipe cross-section area	A = π r^2 =	1.767 sq. ft.	
Pipe hydraulic radius	R = D/4 =	0.3750	
K = 1.486/n((AR$^{2/3}$)	K	105.040	
Then	Q =	18.614 cfs	8354.42 gpm
	V =	10.533 fps	

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: PF-5 to MH E3

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter =	8	in. = or	0.666667 feet
Pipe slope =	0.0092	ft. per foot	
Manning's n =	0.013		
Pipe cross-section area	A = π r^2 =	0.349 sq. ft.	
Pipe hydraulic radius	R = D/4 =	0.1667	
K = 1.486/n((AR$^{2/3}$)	K	12.083	
Then	Q =	1.159 cfs	520.23 gpm
	V =	3.320 fps	

APPENDIX D-1
PIPE CAPACITY CALCS

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: PF-1B to MH G1

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter = 6 in. = or 0.5 feet

Pipe slope = 0.0084 ft. per foot

Manning's n = 0.013

Pipe cross-section area $A = \pi r^2$ = 0.196 sq. ft.

Pipe hydraulic radius R = D/4 = 0.1250

$K = 1.486/n((AR^{2/3})$ K 5.611

Then Q = 0.514 cfs 230.82 gpm
V = 2.619 fps

Job Name: **Parklands**
Job Number:
Date: 10/18/16 1:37 PM
Reach: PF-2 to MH G1

Design Values
Results

Pipe Capacity (Full Flow)

By Manning's Equation

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \quad \text{and,} \quad Q = KS^{1/2}$$

Pipe diameter = 6 in. = or 0.5 feet

Pipe slope = 0.0039 ft. per foot

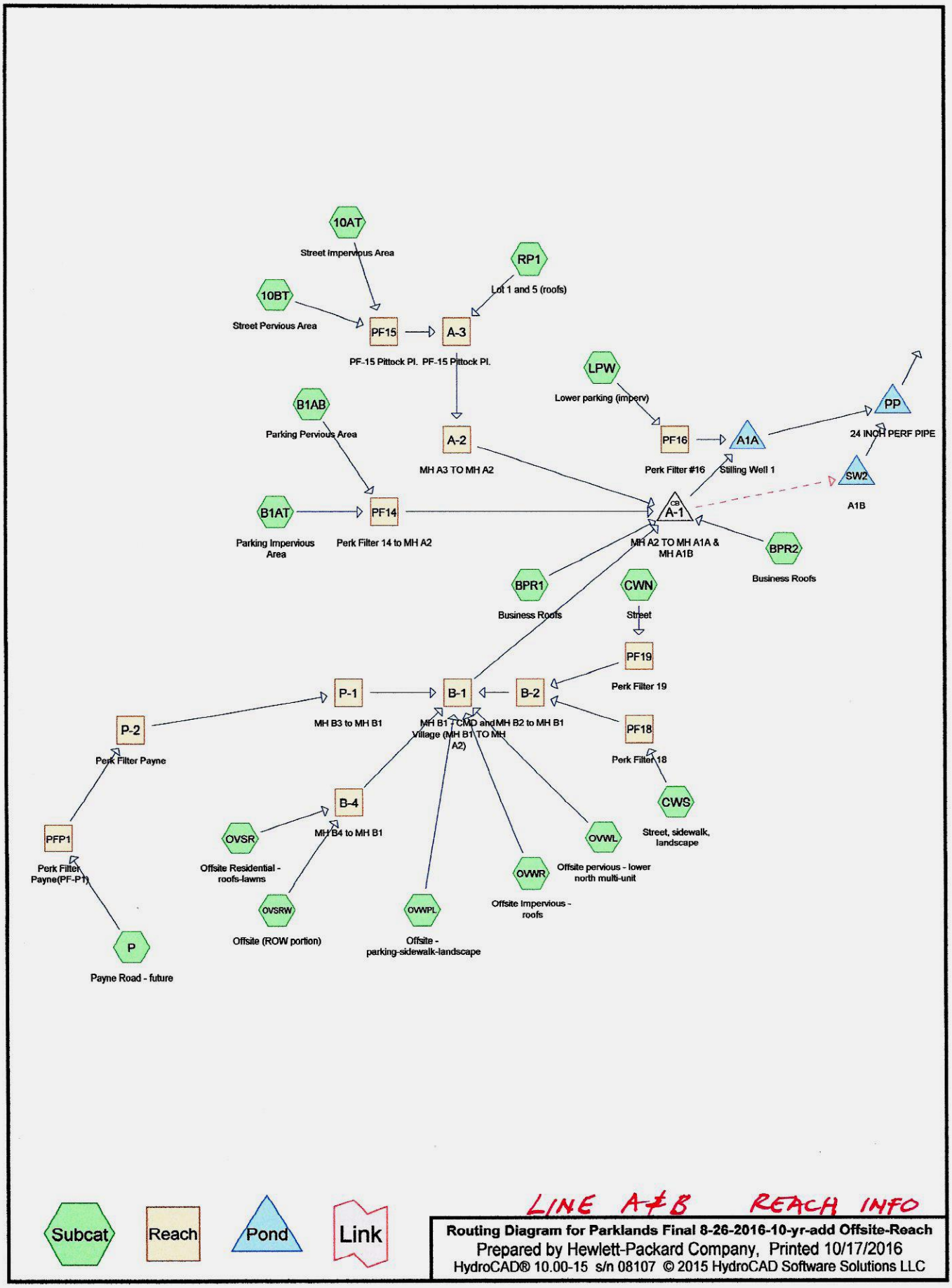
Manning's n = 0.013

Pipe cross-section area $A = \pi r^2$ = 0.196 sq. ft.

Pipe hydraulic radius R = D/4 = 0.1250

$K = 1.486/n((AR^{2/3})$ K 5.611

Then Q = 0.350 cfs 157.28 gpm
V = 1.785 fps


10AT
Street Impervious Area
RP1
Lot 1 and 5 (roofs)
10BT
Street Pervious Area
PF15
A-3
PF-15 Pittock Pl.
PF-15 Pittock Pl.
LPW
Lower parking (imperv)
B1AB
Parking Pervious Area
A-2
MH A3 TO MH A2
PF16
A1A
PP
24 INCH PERF PIPE
Perk Filter #16
Stilling Well 1
SW2
A1B
B1AT
PF14
CB
A-1
Parking Impervious Area
Perk Filter 14 to MH A2
MH A2 TO MH A1A & MH A1B
BPR2
Business Roofs
BPR1
Business Roofs
CWN
Street
PF19
Perk Filter 19
P-1
B-1
B-2
MH B3 to MH B1
MH B1 TMD and Village (MH B1 TO MH A2)
MH B2 to MH B1
P-2
Perk Filter Payne
PF18
Perk Filter 18
CWS
Street, sidewalk, landscape
B-4
MH B4 to MH B1
PFP1
Perk Filter Payne(PF-P1)
OVSR
Offsite Residential - roofs-lawns
OVWL
Offsite pervious - lower north multi-unit
OVWR
Offsite Impervious - roofs
OVSRW
Offsite (ROW portion)
OVWPL
Offsite - parking-sidewalk-landscape
P
Payne Road - future
Subcat
Reach
Pond
Link
LINE A≠B REACH INFO
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-Reach
Prepared by Hewlett-Packard Company, Printed 10/17/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

Parklands Final 8-26-2016-10-yr-add Offsite-Reach

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	A-2	200.60	199.47	143.6	0.0079	0.013	10.0	0.0	0.0
2	A-3	201.36	200.80	112.6	0.0050	0.013	10.0	0.0	0.0
3	B-1	214.65	211.10	188.8	0.0188	0.013	18.0	0.0	0.0
4	B-2	215.49	214.85	67.0	0.0096	0.013	12.0	0.0	0.0
5	B-4	215.67	214.85	61.5	0.0133	0.013	18.0	0.0	0.0
6	P-1	222.38	214.85	222.0	0.0339	0.013	12.0	0.0	0.0
7	P-2	229.07	222.58	116.7	0.0556	0.013	12.0	0.0	0.0
8	PF14	212.80	212.72	10.0	0.0080	0.013	8.0	0.0	0.0
9	PF15	201.36	201.35	2.0	0.0050	0.013	10.0	0.0	0.0
10	PF16	195.73	189.67	9.5	0.6379	0.013	8.0	0.0	0.0
11	PF18	216.64	215.69	28.0	0.0339	0.013	10.0	0.0	0.0
12	PF19	216.64	215.69	28.0	0.0339	0.013	10.0	0.0	0.0
13	PFP1	229.07	229.02	9.0	0.0056	0.013	10.0	0.0	0.0
14	A-1	199.27	188.00	183.6	0.0614	0.013	15.0	0.0	0.0
15	A-1	199.27	188.50	170.6	0.0631	0.013	15.0	0.0	0.0
16	A1A	191.50	191.50	2.0	0.0000	0.013	24.0	0.0	0.0
17	SW2	191.00	191.00	2.0	0.0000	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Reach A-2: MH A3 TO MH A2 Avg. Flow Depth=0.35' Max Vel=3.30 fps Inflow=0.72 cfs 0.240 af
10.0" Round Pipe n=0.013 L=143.6' S=0.0079 '/' Capacity=1.94 cfs Outflow=0.72 cfs 0.240 af

Reach A-3: PF-15 Pittock Pl. Avg. Flow Depth=0.40' Max Vel=2.78 fps Inflow=0.72 cfs 0.240 af
10.0" Round Pipe n=0.013 L=112.6' S=0.0050 '/' Capacity=1.55 cfs Outflow=0.72 cfs 0.240 af

Reach B-1: MH B1 - CMD and Village Avg. Flow Depth=0.89' Max Vel=8.71 fps Inflow=9.53 cfs 3.668 af
18.0" Round Pipe n=0.013 L=188.8' S=0.0188 '/' Capacity=14.40 cfs Outflow=9.53 cfs 3.668 af

Reach B-2: MH B2 to MH B1 Avg. Flow Depth=0.35' Max Vel=3.71 fps Inflow=0.89 cfs 0.321 af
12.0" Round Pipe n=0.013 L=67.0' S=0.0096 '/' Capacity=3.48 cfs Outflow=0.89 cfs 0.321 af

Reach B-4: MH B4 to MH B1 Avg. Flow Depth=0.53' Max Vel=5.79 fps Inflow=3.19 cfs 1.372 af
18.0" Round Pipe n=0.013 L=61.5' S=0.0133 '/' Capacity=12.13 cfs Outflow=3.19 cfs 1.372 af

Reach P-1: MH B3 to MH B1 Avg. Flow Depth=0.14' Max Vel=4.09 fps Inflow=0.27 cfs 0.087 af
12.0" Round Pipe n=0.013 L=222.0' S=0.0339 '/' Capacity=6.56 cfs Outflow=0.27 cfs 0.087 af

Reach P-2: Perk Filter Payne Avg. Flow Depth=0.12' Max Vel=4.86 fps Inflow=0.27 cfs 0.087 af
12.0" Round Pipe n=0.013 L=116.7' S=0.0556 '/' Capacity=8.40 cfs Outflow=0.27 cfs 0.087 af

Reach PF14: Perk Filter 14 to MH A2 Avg. Flow Depth=0.40' Max Vel=3.33 fps Inflow=0.73 cfs 0.247 af
8.0" Round Pipe n=0.013 L=10.0' S=0.0080 '/' Capacity=1.08 cfs Outflow=0.73 cfs 0.247 af

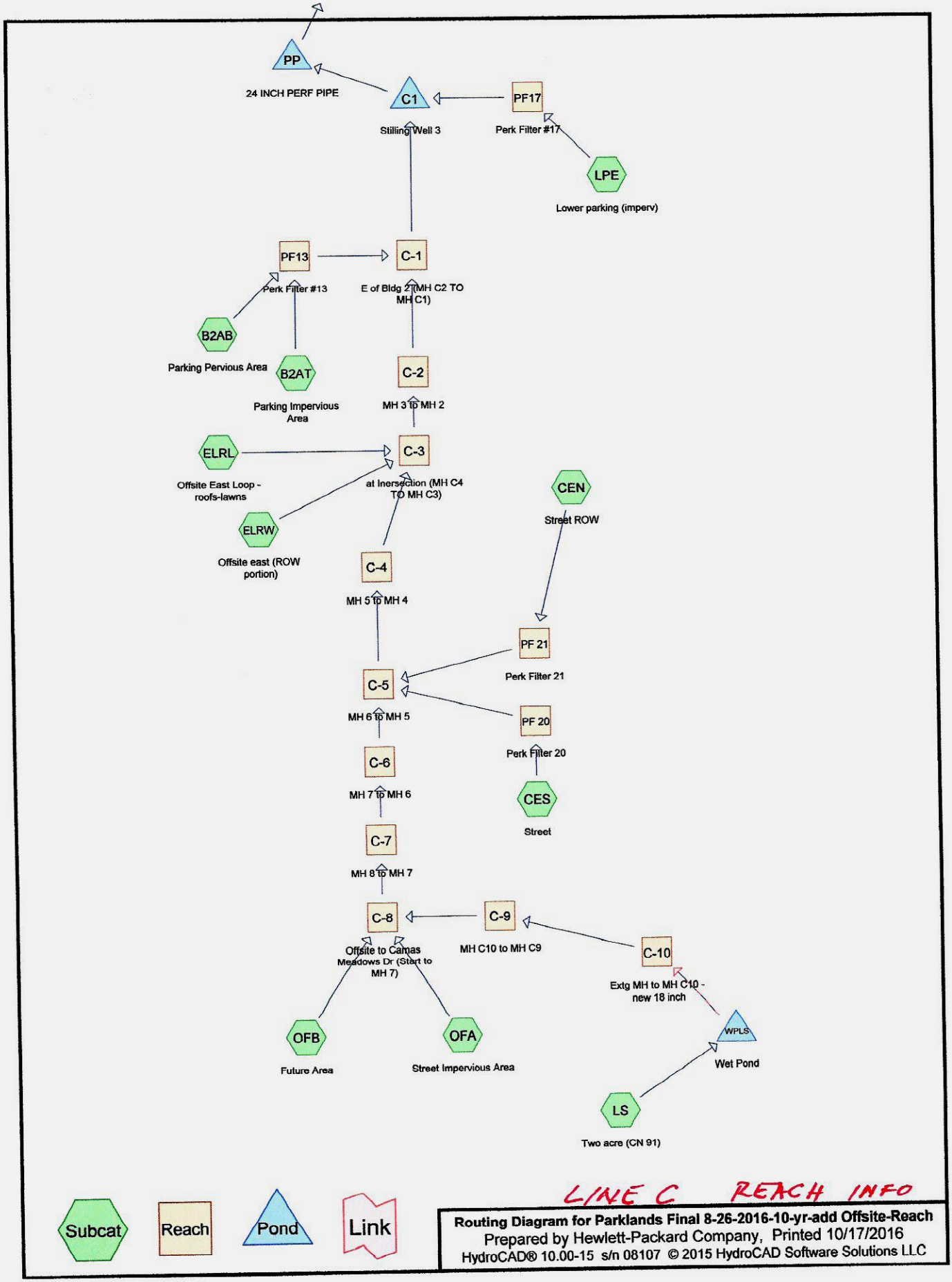
Reach PF15: PF-15 Pittock Pl. Avg. Flow Depth=0.31' Max Vel=2.47 fps Inflow=0.45 cfs 0.152 af
10.0" Round Pipe n=0.013 L=2.0' S=0.0050 '/' Capacity=1.55 cfs Outflow=0.45 cfs 0.152 af

Reach PF16: Perk Filter #16 Avg. Flow Depth=0.10' Max Vel=13.86 fps Inflow=0.42 cfs 0.141 af
8.0" Round Pipe n=0.013 L=9.5' S=0.6379 '/' Capacity=9.65 cfs Outflow=0.42 cfs 0.141 af

Reach PF18: Perk Filter 18 Avg. Flow Depth=0.20' Max Vel=5.04 fps Inflow=0.50 cfs 0.181 af
10.0" Round Pipe n=0.013 L=28.0' S=0.0339 '/' Capacity=4.04 cfs Outflow=0.50 cfs 0.181 af

Reach PF19: Perk Filter 19 Avg. Flow Depth=0.18' Max Vel=4.69 fps Inflow=0.39 cfs 0.140 af
10.0" Round Pipe n=0.013 L=28.0' S=0.0339 '/' Capacity=4.04 cfs Outflow=0.39 cfs 0.140 af

Reach PFP1: Perk Filter Payne(PF-P1) Avg. Flow Depth=0.23' Max Vel=2.21 fps Inflow=0.27 cfs 0.087 af
10.0" Round Pipe n=0.013 L=9.0' S=0.0056 '/' Capacity=1.63 cfs Outflow=0.27 cfs 0.087 af


PP
24 INCH PERF PIPE
C1
Stilling Well 3
PF17
Perk Filter #17
LPE
Lower parking (imperv)
PF13
Perk Filter #13
C-1
E of Bldg 2 (MH C2 TO MH C1)
B2AB
Parking Pervious Area
B2AT
Parking Impervious Area
C-2
MH 3 to MH 2
ELRL
Offsite East Loop - roofs-lawns
C-3
at Inersection (MH C4 TO MH C3)
CEN
Street ROW
ELRW
Offsite east (ROW portion)
C-4
MH 5 to MH 4
PF 21
Perk Filter 21
C-5
MH 6 to MH 5
PF 20
Perk Filter 20
C-6
MH 7 to MH 6
CES
Street
C-7
MH 8 to MH 7
C-8
C-9
MH C10 to MH C9
C-10
Extg MH to MH C10 - new 18 inch
Offsite to Camas Meadows Dr (Start to MH 7)
OFB
Future Area
OFA
Street Impervious Area
WPLS
Wet Pond
LS
Two acre (CN 91)
Subcat
Reach
Pond
Link
LINE C REACH INFO
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-Reach
Prepared by Hewlett-Packard Company, Printed 10/17/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

Parklands Final 8-26-2016-10-yr-add Offsite-Reach
Prepared by Hewlett-Packard Company

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	C-1	200.80	189.00	158.5	0.0744	0.013	18.0	0.0	0.0
2	C-10	238.72	237.68	163.4	0.0064	0.013	18.0	0.0	0.0
3	C-2	219.88	201.00	134.0	0.1409	0.013	18.0	0.0	0.0
4	C-3	220.21	220.08	55.6	0.0023	0.013	30.0	0.0	0.0
5	C-4	220.90	220.21	96.4	0.0072	0.013	30.0	0.0	0.0
6	C-5	221.74	221.10	118.1	0.0054	0.013	30.0	0.0	0.0
7	C-6	224.52	221.94	149.8	0.0172	0.013	30.0	0.0	0.0
8	C-7	228.59	224.72	166.3	0.0233	0.013	24.0	0.0	0.0
9	C-8	237.25	228.79	200.0	0.0423	0.013	24.0	0.0	0.0
10	C-9	237.68	237.25	121.7	0.0035	0.013	18.0	0.0	0.0
11	PF 20	225.19	224.01	21.8	0.0541	0.013	10.0	0.0	0.0
12	PF 21	226.02	223.99	21.8	0.0931	0.013	10.0	0.0	0.0
13	PF13	211.87	206.00	63.5	0.0924	0.013	8.0	0.0	0.0
14	PF17	199.05	190.22	16.4	0.5384	0.013	8.0	0.0	0.0
15	C1	192.00	192.00	2.0	0.0000	0.013	24.0	0.0	0.0
16	WPLS	239.08	238.92	112.6	0.0014	0.013	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Reach C-1: E of Bldg 2 (MH C2 TO MH Avg. Flow Depth=0.82' Max Vel=16.78 fps Inflow=16.50 cfs 6.783 af
18.0" Round Pipe n=0.013 L=158.5' S=0.0744 '/' Capacity=28.66 cfs Outflow=16.50 cfs 6.783 af

Reach C-10: Extg MH to MH C10 - new Avg. Flow Depth=0.56' Max Vel=4.12 fps Inflow=2.46 cfs 1.701 af
18.0" Round Pipe n=0.013 L=163.4' S=0.0064 '/' Capacity=8.38 cfs Outflow=2.46 cfs 1.701 af

Reach C-2: MH 3 to MH 2 Avg. Flow Depth=0.67' Max Vel=21.16 fps Inflow=16.04 cfs 6.624 af
18.0" Round Pipe n=0.013 L=134.0' S=0.1409 '/' Capacity=39.43 cfs Outflow=16.04 cfs 6.624 af

Reach C-3: at Inersection (MH C4 TO Avg. Flow Depth=1.71' Max Vel=4.50 fps Inflow=16.04 cfs 6.624 af
30.0" Round Pipe n=0.013 L=55.6' S=0.0023 '/' Capacity=19.83 cfs Outflow=16.04 cfs 6.624 af

Reach C-4: MH 5 to MH 4 Avg. Flow Depth=1.11' Max Vel=6.70 fps Inflow=14.05 cfs 5.804 af
30.0" Round Pipe n=0.013 L=96.4' S=0.0072 '/' Capacity=34.70 cfs Outflow=14.07 cfs 5.804 af

Reach C-5: MH 6 to MH 5 Avg. Flow Depth=1.20' Max Vel=6.04 fps Inflow=14.05 cfs 5.804 af
30.0" Round Pipe n=0.013 L=118.1' S=0.0054 '/' Capacity=30.19 cfs Outflow=14.05 cfs 5.804 af

Reach C-6: MH 7 to MH 6 Avg. Flow Depth=0.84' Max Vel=9.06 fps Inflow=13.15 cfs 5.477 af
30.0" Round Pipe n=0.013 L=149.8' S=0.0172 '/' Capacity=53.83 cfs Outflow=13.14 cfs 5.477 af

Reach C-7: MH 8 to MH 7 Avg. Flow Depth=0.86' Max Vel=10.24 fps Inflow=13.15 cfs 5.477 af
24.0" Round Pipe n=0.013 L=166.3' S=0.0233 '/' Capacity=34.51 cfs Outflow=13.15 cfs 5.477 af

Reach C-8: Offsite to Camas Avg. Flow Depth=0.73' Max Vel=12.74 fps Inflow=13.16 cfs 5.477 af
24.0" Round Pipe n=0.013 L=200.0' S=0.0423 '/' Capacity=46.53 cfs Outflow=13.15 cfs 5.477 af

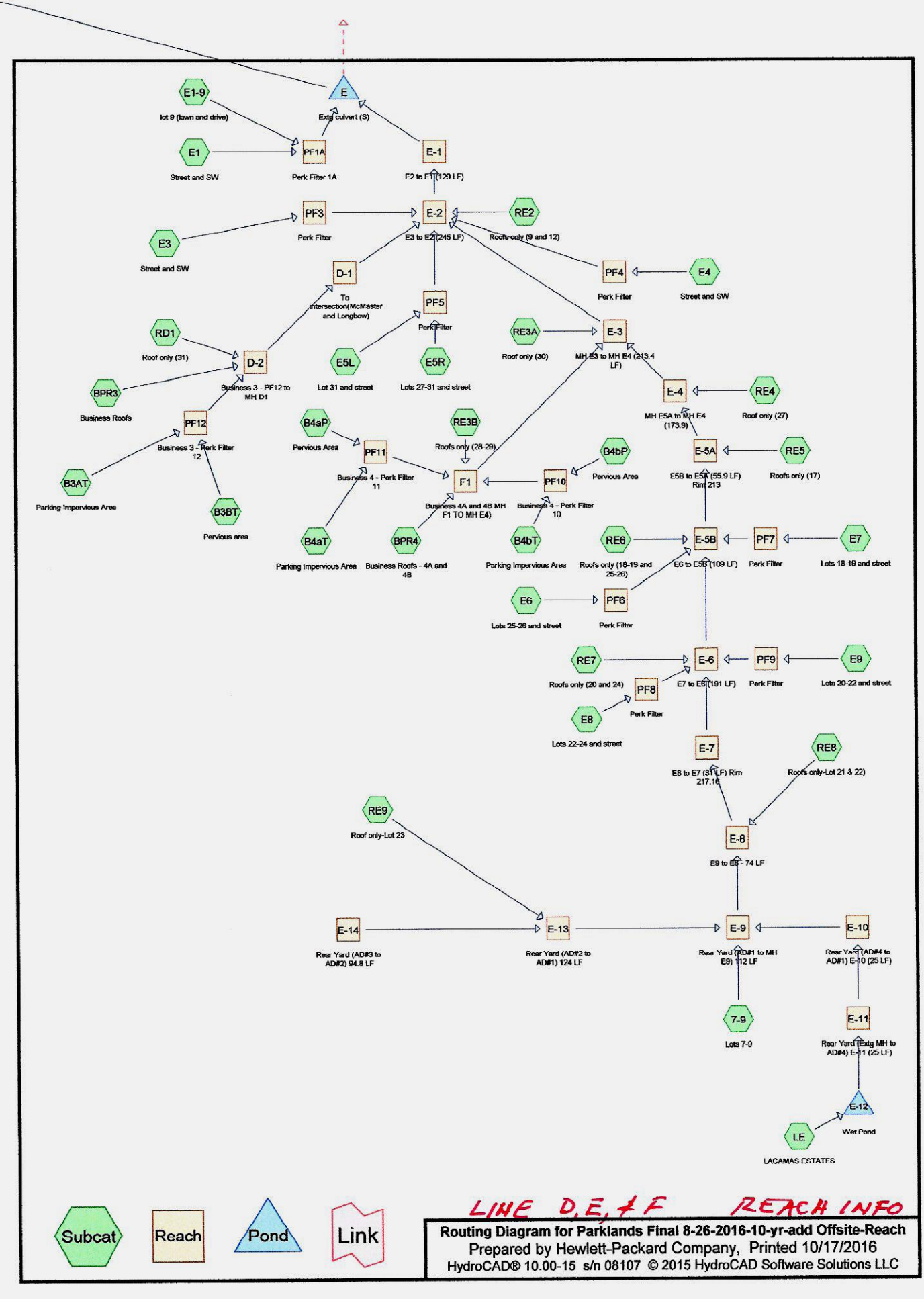
Reach C-9: MH C10 to MH C9 Avg. Flow Depth=0.65' Max Vel=3.32 fps Inflow=2.46 cfs 1.701 af
18.0" Round Pipe n=0.013 L=121.7' S=0.0035 '/' Capacity=6.24 cfs Outflow=2.46 cfs 1.701 af

Reach PF 20: Perk Filter 20 Avg. Flow Depth=0.16' Max Vel=5.68 fps Inflow=0.43 cfs 0.155 af
10.0" Round Pipe n=0.013 L=21.8' S=0.0541 '/' Capacity=5.10 cfs Outflow=0.43 cfs 0.155 af

Reach PF 21: Perk Filter 21 Avg. Flow Depth=0.15' Max Vel=7.10 fps Inflow=0.48 cfs 0.172 af
10.0" Round Pipe n=0.013 L=21.8' S=0.0931 '/' Capacity=6.69 cfs Outflow=0.48 cfs 0.172 af

Reach PF13: Perk Filter #13 Avg. Flow Depth=0.16' Max Vel=7.24 fps Inflow=0.47 cfs 0.160 af
8.0" Round Pipe n=0.013 L=63.5' S=0.0924 '/' Capacity=3.67 cfs Outflow=0.47 cfs 0.160 af

Reach PF17: Perk Filter #17 Avg. Flow Depth=0.10' Max Vel=13.05 fps Inflow=0.42 cfs 0.141 af
8.0" Round Pipe n=0.013 L=16.4' S=0.5384 '/' Capacity=8.87 cfs Outflow=0.42 cfs 0.141 af


E
E1-9
lot 9 (lawn and drive)
Extg culvert (S)
E1
Street and SW
PF1A
Perk Filter 1A
E-1
E2 to E1 (129 LF)
PF3
Perk Filter
E-2
E3 to E2 (245 LF)
RE2
Roofs only (9 and 12)
E3
Street and SW
D-1
To intersection(McMaster and Longbow)
PF4
Perk Filter
E4
Street and SW
PF5
Perk Filter
RD1
Roof only (31)
D-2
Business 3 - PF12 to MH D1
E5L
Lot 31 and street
E5R
Lots 27-31 and street
RE3A
Roof only (30)
E-3
MH E3 to MH E4 (213.4 LF)
BPR3
Business Roofs
E-4
MH E5A to MH E4 (173.9)
RE4
Roof only (27)
PF12
Business 3 - Perk Filter 12
B4aP
Pervious Area
PF11
Business 4 - Perk Filter 11
RE3B
Roofs only (28-29)
E-5A
E5B to E5A (55.9 LF) Rim 213
RE5
Roofs only (17)
B3AT
Parking Impervious Area
B3BT
Pervious area
F1
Business 4A and 4B MH F1 TO MH E4)
PF10
Business 4 - Perk Filter 10
B4bP
Pervious Area
B4aT
Parking Impervious Area
BPR4
Business Roofs - 4A and 4B
B4bT
Parking Impervious Area
RE6
Roofs only (18-19 and 25-26)
E-5B
E6 to E5B (109 LF)
PF7
Perk Filter
E7
Lots 18-19 and street
E6
Lots 25-26 and street
PF6
Perk Filter
RE7
Roofs only (20 and 24)
E-6
E7 to E6 (191 LF)
PF9
Perk Filter
E9
Lots 20-22 and street
PF8
Perk Filter
E8
Lots 22-24 and street
E-7
E8 to E7 (81 LF) Rim 217.16
RE8
Roofs only-Lot 21 & 22)
RE9
Roof only-Lot 23
E-8
E9 to E8 - 74 LF
E-14
Rear Yard (AD#3 to AD#2) 94.8 LF
E-13
Rear Yard (AD#2 to AD#1) 124 LF
E-9
Rear Yard (AD#1 to MH E9) 112 LF
E-10
Rear Yard (AD#4 to AD#1) E-10 (25 LF)
7-9
Lots 7-9
E-11
Rear Yard (Extg MH to AD#4) E-11 (25 LF)
E-12
Wet Pond
LE
LACAMAS ESTATES
Subcat
Reach
Pond
Link
LINE D, E, & F REACH INFO
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-Reach
Prepared by Hewlett-Packard Company, Printed 10/17/2016
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Parklands Final 8-26-2016-10-yr-add Offsite-Reach
Prepared by Hewlett-Packard Company

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	D-1	200.00	198.29	135.8	0.0126	0.013	12.0	0.0	0.0
2	D-2	215.79	200.64	138.0	0.1098	0.013	10.0	0.0	0.0
3	E-1	190.00	187.98	129.1	0.0156	0.013	18.0	0.0	0.0
4	E-10	215.50	214.00	115.3	0.0130	0.013	15.0	0.0	0.0
5	E-11	218.62	217.00	14.0	0.1157	0.013	12.0	0.0	0.0
6	E-13	216.00	215.50	124.0	0.0040	0.013	12.0	0.0	0.0
7	E-14	226.00	216.00	94.8	0.1055	0.013	12.0	0.0	0.0
8	E-2	198.09	190.20	244.9	0.0322	0.013	18.0	0.0	0.0
9	E-3	205.00	198.29	213.4	0.0314	0.013	18.0	0.0	0.0
10	E-4	205.00	198.29	173.9	0.0386	0.013	18.0	0.0	0.0
11	E-5A	209.00	205.20	55.9	0.0680	0.013	18.0	0.0	0.0
12	E-5B	210.15	209.20	93.4	0.0102	0.013	18.0	0.0	0.0
13	E-6	212.15	210.35	196.3	0.0092	0.013	15.0	0.0	0.0
14	E-7	213.00	212.35	84.3	0.0077	0.013	15.0	0.0	0.0
15	E-8	214.00	213.00	76.5	0.0131	0.013	15.0	0.0	0.0
16	E-9	215.50	214.00	115.3	0.0130	0.013	15.0	0.0	0.0
17	F1	215.45	205.29	180.7	0.0562	0.013	12.0	0.0	0.0
18	PF10	220.90	215.55	85.6	0.0625	0.013	10.0	0.0	0.0
19	PF11	220.68	215.55	125.6	0.0408	0.013	10.0	0.0	0.0
20	PF12	215.79	215.78	1.0	0.0100	0.013	10.0	0.0	0.0
21	PF1A	188.52	187.47	26.0	0.0404	0.013	8.0	0.0	0.0
22	PF3	199.47	199.40	15.0	0.0047	0.013	8.0	0.0	0.0
23	PF4	198.38	198.33	10.0	0.0050	0.013	8.0	0.0	0.0
24	PF5	198.41	198.29	13.0	0.0092	0.013	8.0	0.0	0.0
25	PF6	210.21	210.15	12.0	0.0050	0.013	8.0	0.0	0.0
26	PF7	210.21	210.15	10.0	0.0060	0.013	8.0	0.0	0.0
27	PF8	212.21	212.15	12.0	0.0050	0.013	8.0	0.0	0.0
28	PF9	212.21	212.15	10.0	0.0060	0.013	8.0	0.0	0.0
29	E	187.47	187.47	30.0	0.0000	0.013	24.0	0.0	0.0
30	E	187.98	186.06	43.0	0.0447	0.013	24.0	0.0	0.0
31	E-12	222.68	222.53	6.5	0.0231	0.013	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Reach D-1: To intersection(McMaster Avg. Flow Depth=0.39' Max Vel=4.55 fps Inflow=1.31 cfs 0.441 af
12.0" Round Pipe n=0.013 L=135.8' S=0.0126 '/' Capacity=4.00 cfs Outflow=1.31 cfs 0.441 af

Reach D-2: Business 3 - PF12 to MH D1 Avg. Flow Depth=0.24' Max Vel=10.08 fps Inflow=1.31 cfs 0.441 af
10.0" Round Pipe n=0.013 L=138.0' S=0.1098 '/' Capacity=7.26 cfs Outflow=1.31 cfs 0.441 af

Reach E-1: E2 to E1 (129 LF) Avg. Flow Depth=1.07' Max Vel=8.36 fps Inflow=11.32 cfs 4.892 af
18.0" Round Pipe n=0.013 L=129.1' S=0.0156 '/' Capacity=13.14 cfs Outflow=11.33 cfs 4.892 af

Reach E-10: Rear Yard (AD#4 to AD#1) Avg. Flow Depth=0.55' Max Vel=5.66 fps Inflow=2.94 cfs 1.741 af
15.0" Round Pipe n=0.013 L=115.3' S=0.0130 '/' Capacity=7.37 cfs Outflow=2.94 cfs 1.741 af

Reach E-11: Rear Yard (Extg MH to Avg. Flow Depth=0.34' Max Vel=12.72 fps Inflow=2.94 cfs 1.741 af
12.0" Round Pipe n=0.013 L=14.0' S=0.1157 '/' Capacity=12.12 cfs Outflow=2.94 cfs 1.741 af

Reach E-13: Rear Yard (AD#2 to AD#1) Avg. Flow Depth=0.16' Max Vel=1.58 fps Inflow=0.13 cfs 0.044 af
12.0" Round Pipe n=0.013 L=124.0' S=0.0040 '/' Capacity=2.26 cfs Outflow=0.13 cfs 0.044 af

Reach E-14: Rear Yard (AD#3 to AD#2) 94.8 LF Avg. Flow Depth=0.00' Max Vel=0.00 fps
12.0" Round Pipe n=0.013 L=94.8' S=0.1055 '/' Capacity=11.57 cfs Outflow=0.00 cfs 0.000 af

Reach E-2: E3 to E2 (245 LF) Avg. Flow Depth=0.84' Max Vel=11.15 fps Inflow=11.32 cfs 4.892 af
18.0" Round Pipe n=0.013 L=244.9' S=0.0322 '/' Capacity=18.85 cfs Outflow=11.32 cfs 4.892 af

Reach E-3: MH E3 to MH E4 (213.4 LF) Avg. Flow Depth=0.69' Max Vel=10.17 fps Inflow=8.11 cfs 3.742 af
18.0" Round Pipe n=0.013 L=213.4' S=0.0314 '/' Capacity=18.63 cfs Outflow=8.11 cfs 3.742 af

Reach E-4: MH E5A to MH E4 (173.9) Avg. Flow Depth=0.53' Max Vel=9.92 fps Inflow=5.60 cfs 2.864 af
18.0" Round Pipe n=0.013 L=173.9' S=0.0386 '/' Capacity=20.63 cfs Outflow=5.59 cfs 2.864 af

Reach E-5A: E5B to E5A (55.9 LF) Rim Avg. Flow Depth=0.45' Max Vel=12.09 fps Inflow=5.47 cfs 2.820 af
18.0" Round Pipe n=0.013 L=55.9' S=0.0680 '/' Capacity=27.39 cfs Outflow=5.47 cfs 2.820 af

Reach E-5B: E6 to E5B (109 LF) Avg. Flow Depth=0.75' Max Vel=6.01 fps Inflow=5.35 cfs 2.775 af
18.0" Round Pipe n=0.013 L=93.4' S=0.0102 '/' Capacity=10.59 cfs Outflow=5.35 cfs 2.775 af

Reach E-6: E7 to E6 (191 LF) Avg. Flow Depth=0.76' Max Vel=5.44 fps Inflow=4.27 cfs 2.370 af
15.0" Round Pipe n=0.013 L=196.3' S=0.0092 '/' Capacity=6.19 cfs Outflow=4.27 cfs 2.370 af

Reach E-7: E8 to E7 (81 LF) Rim 217.16 Avg. Flow Depth=0.70' Max Vel=4.85 fps Inflow=3.45 cfs 2.038 af
15.0" Round Pipe n=0.013 L=84.3' S=0.0077 '/' Capacity=5.67 cfs Outflow=3.45 cfs 2.038 af

Reach E-8: E9 to E8 - 74 LF Avg. Flow Depth=0.60' Max Vel=5.92 fps Inflow=3.45 cfs 2.038 af
15.0" Round Pipe n=0.013 L=76.5' S=0.0131 '/' Capacity=7.39 cfs Outflow=3.45 cfs 2.038 af

Reach E-9: Rear Yard (AD#1 to MH E9) Avg. Flow Depth=0.59' Max Vel=5.84 fps Inflow=3.31 cfs 1.949 af
15.0" Round Pipe n=0.013 L=115.3' S=0.0130 '/' Capacity=7.37 cfs Outflow=3.31 cfs 1.949 af

Reach F1: Business 4A and 4B MH F1 Avg. Flow Depth=0.37' Max Vel=9.34 fps Inflow=2.48 cfs 0.834 af
12.0" Round Pipe n=0.013 L=180.7' S=0.0562 '/' Capacity=8.45 cfs Outflow=2.48 cfs 0.834 af

Reach PF10: Business 4 - Perk Filter 10 Avg. Flow Depth=0.22' Max Vel=7.27 fps Inflow=0.84 cfs 0.281 af
10.0" Round Pipe n=0.013 L=85.6' S=0.0625 '/' Capacity=5.48 cfs Outflow=0.84 cfs 0.281 af

Reach PF11: Business 4 - Perk Filter 11 Avg. Flow Depth=0.23' Max Vel=6.06 fps Inflow=0.76 cfs 0.253 af
10.0" Round Pipe n=0.013 L=125.6' S=0.0408 '/' Capacity=4.43 cfs Outflow=0.76 cfs 0.253 af

Reach PF12: Business 3 - Perk Filter 12 Avg. Flow Depth=0.33' Max Vel=3.62 fps Inflow=0.73 cfs 0.247 af
10.0" Round Pipe n=0.013 L=1.0' S=0.0100 '/' Capacity=2.19 cfs Outflow=0.73 cfs 0.247 af

Reach PF1A: Perk Filter 1A Avg. Flow Depth=0.14' Max Vel=4.36 fps Inflow=0.23 cfs 0.079 af
8.0" Round Pipe n=0.013 L=26.0' S=0.0404 '/' Capacity=2.43 cfs Outflow=0.23 cfs 0.079 af

Reach PF3: Perk Filter Avg. Flow Depth=0.27' Max Vel=2.14 fps Inflow=0.28 cfs 0.094 af
8.0" Round Pipe n=0.013 L=15.0' S=0.0047 '/' Capacity=0.83 cfs Outflow=0.28 cfs 0.094 af

Reach PF4: Perk Filter Avg. Flow Depth=0.31' Max Vel=2.37 fps Inflow=0.38 cfs 0.129 af
8.0" Round Pipe n=0.013 L=10.0' S=0.0050 '/' Capacity=0.85 cfs Outflow=0.38 cfs 0.129 af

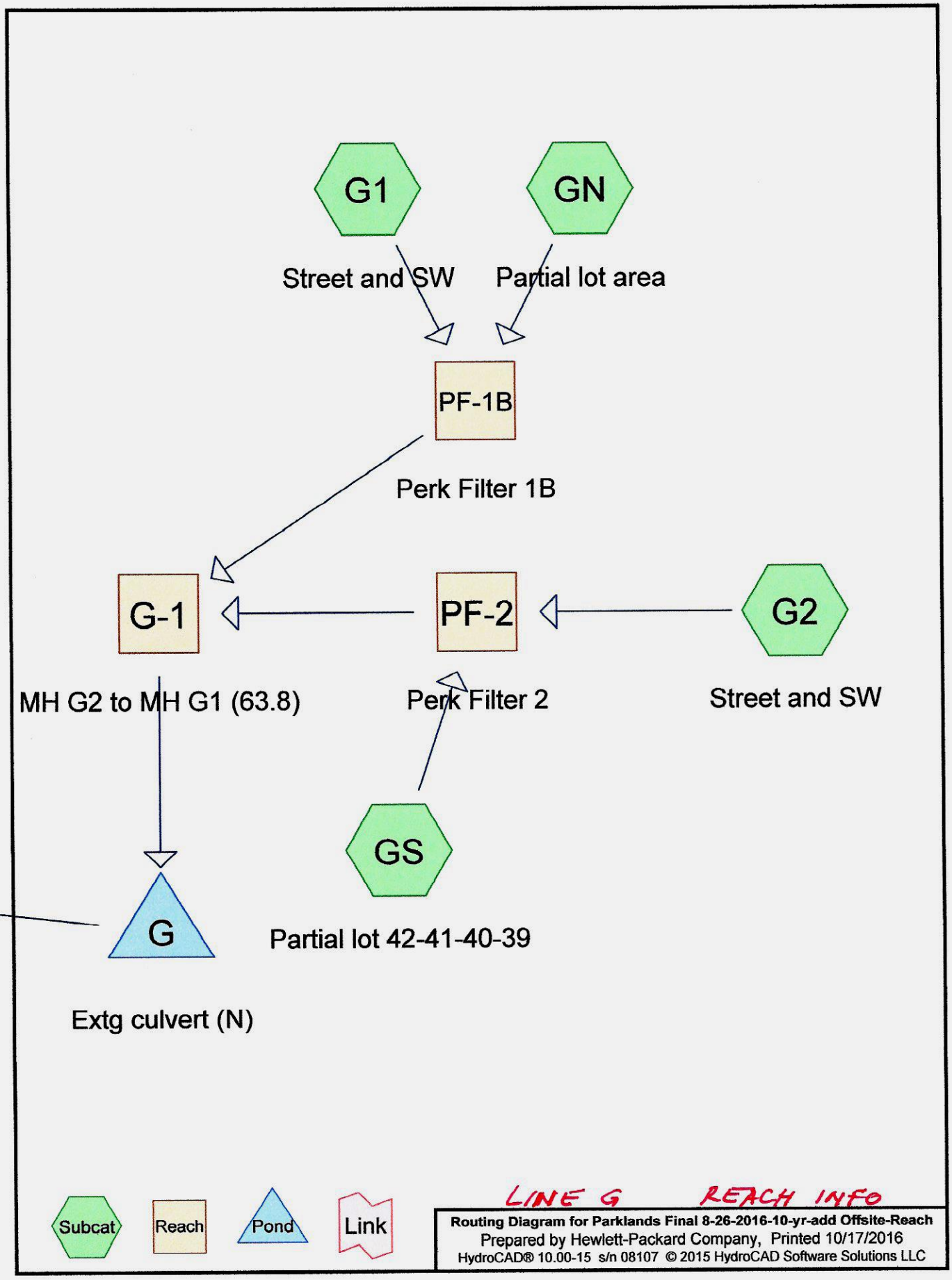
Reach PF5: Perk Filter Avg. Flow Depth=0.50' Max Vel=3.77 fps Inflow=1.05 cfs 0.398 af
8.0" Round Pipe n=0.013 L=13.0' S=0.0092 '/' Capacity=1.16 cfs Outflow=1.05 cfs 0.398 af

Reach PF6: Perk Filter Avg. Flow Depth=0.27' Max Vel=2.24 fps Inflow=0.30 cfs 0.114 af
8.0" Round Pipe n=0.013 L=12.0' S=0.0050 '/' Capacity=0.85 cfs Outflow=0.30 cfs 0.114 af

Reach PF7: Perk Filter Avg. Flow Depth=0.26' Max Vel=2.39 fps Inflow=0.30 cfs 0.114 af
8.0" Round Pipe n=0.013 L=10.0' S=0.0060 '/' Capacity=0.94 cfs Outflow=0.30 cfs 0.114 af

Reach PF8: Perk Filter Avg. Flow Depth=0.28' Max Vel=2.27 fps Inflow=0.32 cfs 0.122 af
8.0" Round Pipe n=0.013 L=12.0' S=0.0050 '/' Capacity=0.85 cfs Outflow=0.32 cfs 0.122 af

Reach PF9: Perk Filter Avg. Flow Depth=0.27' Max Vel=2.43 fps Inflow=0.32 cfs 0.122 af
8.0" Round Pipe n=0.013 L=10.0' S=0.0060 '/' Capacity=0.94 cfs Outflow=0.32 cfs 0.122 af


G1
GN
Street and SW
Partial lot area
PF-1B
Perk Filter 1B
G-1
PF-2
G2
MH G2 to MH G1 (63.8)
Perk Filter 2
Street and SW
GS
G
Partial lot 42-41-40-39
Extg culvert (N)
Subcat
Reach
Pond
Link
LINE G REACH INFO
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-Reach
Prepared by Hewlett-Packard Company, Printed 10/17/2016
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Parklands Final 8-26-2016-10-yr-add Offsite-Reach

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	G-1	186.34	186.07	63.8	0.0042	0.013	12.0	0.0	0.0
2	PF-1B	186.50	186.34	19.0	0.0084	0.013	6.0	0.0	0.0
3	PF-2	186.41	186.34	18.0	0.0039	0.013	6.0	0.0	0.0
4	G	186.06	186.06	15.0	0.0000	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment G1: Street and SW Runoff Area=19,098 sf 83.10% Impervious Runoff Depth=3.28"
Tc=5.0 min CN=80.0/98.0 Runoff=0.36 cfs 0.120 af

Subcatchment G2: Street and SW Runoff Area=13,561 sf 90.52% Impervious Runoff Depth=3.41"
Tc=5.0 min CN=80.0/98.0 Runoff=0.26 cfs 0.088 af

Subcatchment GN: Partial lot area Runoff Area=24,500 sf 26.53% Impervious Runoff Depth=2.50"
Tc=10.0 min CN=83.0/98.0 Runoff=0.33 cfs 0.117 af

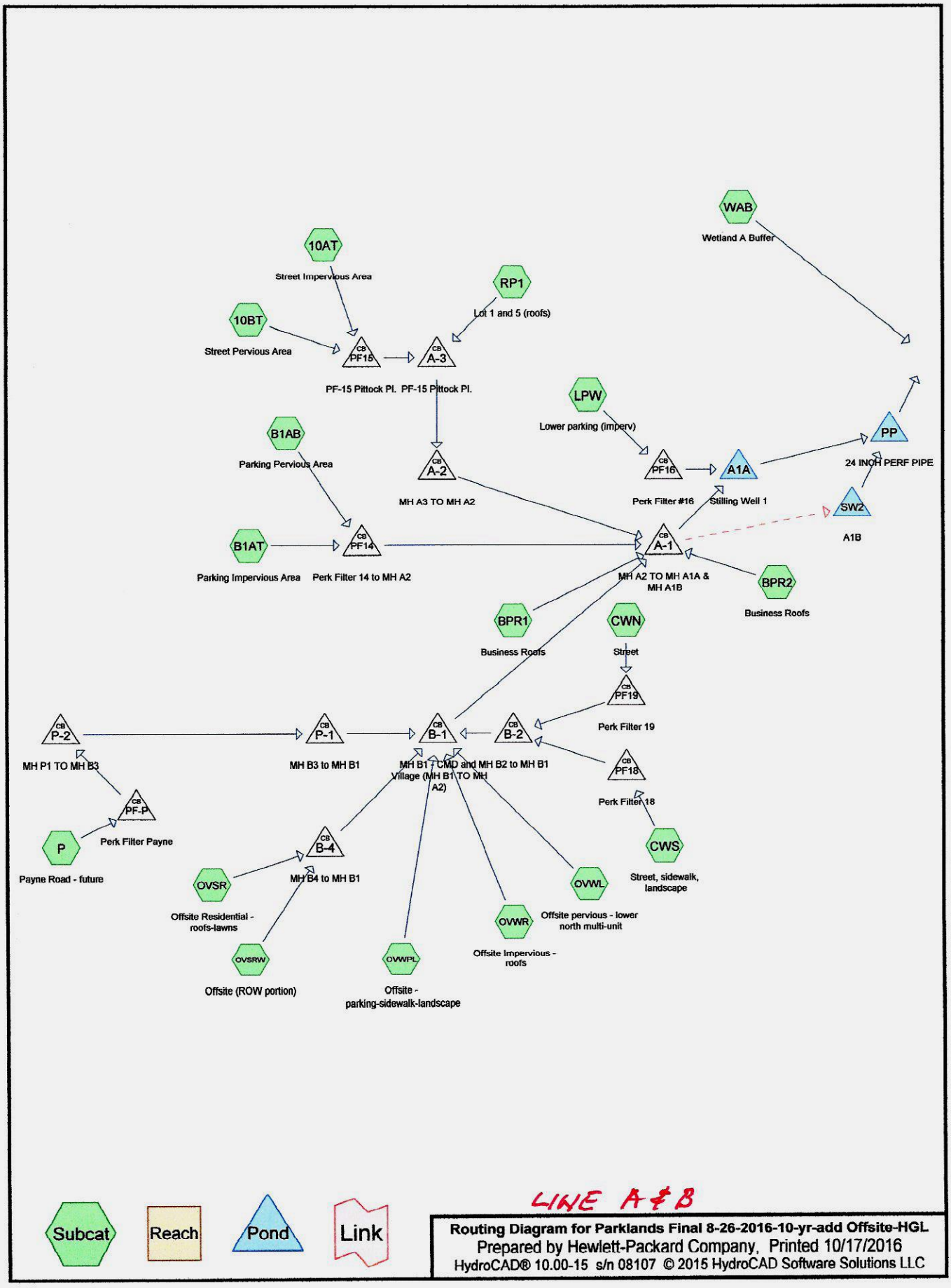
Subcatchment GS: Partial lot 42-41-40-39 Runoff Area=18,500 sf 27.03% Impervious Runoff Depth=2.51"
Tc=10.0 min CN=83.0/98.0 Runoff=0.25 cfs 0.089 af

Reach G-1: MH G2 to MH G1 (63.8) Avg. Flow Depth=0.43' Max Vel=2.76 fps Inflow=0.89 cfs 0.414 af
12.0" Round Pipe n=0.013 L=63.8' S=0.0042 '/' Capacity=2.32 cfs Outflow=0.89 cfs 0.414 af

Reach PF-1B: Perk Filter 1B Avg. Flow Depth=0.50' Max Vel=2.99 fps Inflow=0.68 cfs 0.237 af
6.0" Round Pipe n=0.013 L=19.0' S=0.0084 '/' Capacity=0.51 cfs Outflow=0.54 cfs 0.237 af

Reach PF-2: Perk Filter 2 Avg. Flow Depth=0.50' Max Vel=2.03 fps Inflow=0.51 cfs 0.177 af
6.0" Round Pipe n=0.013 L=18.0' S=0.0039 '/' Capacity=0.35 cfs Outflow=0.38 cfs 0.177 af

Pond G: Extg culvert (N) Peak Elev=188.31' Storage=42 cf Inflow=7.58 cfs 2.642 af
24.0" Round Culvert n=0.013 L=15.0' S=0.0000 '/' Outflow=7.58 cfs 2.641 af


WAB
Wetland A Buffer
10AT
Street Impervious Area
RP1
Lot 1 and 5 (roofs)
10BT
Street Pervious Area
CB PF15
CB A-3
PF-15 Pittock Pl. PF-15 Pittock Pl.
LPW
Lower parking (imperv)
PP
24 INCH PERF PIPE
B1AB
Parking Pervious Area
CB A-2
MH A3 TO MH A2
CB PF16
A1A
Perk Filter #16
Stilling Well 1
SW2
A1B
B1AT
Parking Impervious Area
CB PF14
Perk Filter 14 to MH A2
CB A-1
MH A2 TO MH A1A & MH A1B
BPR2
Business Roofs
BPR1
Business Roofs
CWN
Street
CB PF19
Perk Filter 19
CB P-2
MH P1 TO MH B3
CB P-1
MH B3 to MH B1
CB B-1
MH B1 - CMD and MH B2 to MH B1 Village (MH B1 TO MH A2)
CB B-2
CB PF18
Perk Filter 18
CB PF-P
Perk Filter Payne
P
Payne Road - future
CB B-4
MH B4 to MH B1
CWS
Street, sidewalk, landscape
OVSR
Offsite Residential - roofs-lawns
OVWL
Offsite pervious - lower north multi-unit
OVWR
Offsite Impervious - roofs
OVSRW
Offsite (ROW portion)
OVWPL
Offsite - parking-sidewalk-landscape
Subcat
Reach
Pond
Link
LINE A & B
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/17/2016
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Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	A-1	199.27	188.00	183.6	0.0614	0.013	15.0	0.0	0.0
2	A-1	199.27	188.50	170.6	0.0631	0.013	15.0	0.0	0.0
3	A-2	200.60	199.47	143.6	0.0079	0.013	10.0	0.0	0.0
4	A-3	201.36	200.80	112.6	0.0050	0.013	10.0	0.0	0.0
5	A1A	191.50	191.50	2.0	0.0000	0.013	24.0	0.0	0.0
6	B-1	214.65	211.10	188.8	0.0188	0.013	18.0	0.0	0.0
7	B-2	215.49	214.85	67.0	0.0096	0.013	12.0	0.0	0.0
8	B-4	215.67	214.85	61.5	0.0133	0.013	18.0	0.0	0.0
9	P-1	222.38	214.85	222.0	0.0339	0.013	12.0	0.0	0.0
10	P-2	229.02	222.58	116.7	0.0552	0.013	12.0	0.0	0.0
11	PF-P	229.07	229.02	9.0	0.0056	0.013	10.0	0.0	0.0
12	PF14	212.80	212.72	10.0	0.0080	0.013	8.0	0.0	0.0
13	PF15	201.36	201.31	1.0	0.0500	0.013	10.0	0.0	0.0
14	PF16	195.73	188.95	9.5	0.7137	0.013	8.0	0.0	0.0
15	PF18	216.64	215.69	28.0	0.0339	0.013	10.0	0.0	0.0
16	PF19	216.64	215.69	28.0	0.0339	0.013	10.0	0.0	0.0
17	SW2	191.00	191.00	2.0	0.0000	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 10AT: Street Impervious Runoff Area=15,797 sf 100.00% Impervious Runoff Depth=3.57"
Tc=5.0 min CN=0.0/98.0 Runoff=0.32 cfs 0.108 af

Subcatchment 10BT: Street Pervious Area Runoff Area=9,720 sf 0.00% Impervious Runoff Depth=2.37"
Tc=5.0 min CN=86.0/0.0 Runoff=0.13 cfs 0.044 af

Subcatchment B1AB: Parking Pervious Area Runoff Area=5,160 sf 0.00% Impervious Runoff Depth=1.95"
Tc=10.0 min CN=81.0/0.0 Runoff=0.05 cfs 0.019 af

Subcatchment B1AT: Parking Impervious Runoff Area=33,428 sf 100.00% Impervious Runoff Depth=3.57"
Tc=5.0 min CN=0.0/98.0 Runoff=0.68 cfs 0.228 af

Subcatchment BPR1: Business Roofs Runoff Area=3,000 sf 100.00% Impervious Runoff Depth=3.57"
Tc=5.0 min CN=0.0/98.0 Runoff=0.06 cfs 0.020 af

Subcatchment BPR2: Business Roofs Runoff Area=19,857 sf 100.00% Impervious Runoff Depth=3.57"
Tc=5.0 min CN=0.0/98.0 Runoff=0.41 cfs 0.135 af

Subcatchment CWN: Street Runoff Area=22,251 sf 82.63% Impervious Runoff Depth=3.29"
Tc=11.0 min CN=81.0/98.0 Runoff=0.39 cfs 0.140 af

Subcatchment CWS: Street, sidewalk, Runoff Area=30,128 sf 73.27% Impervious Runoff Depth=3.14"
Tc=11.0 min CN=81.0/98.0 Runoff=0.50 cfs 0.181 af

Subcatchment LPW: Lower parking Runoff Area=21,245 sf 93.58% Impervious Runoff Depth=3.47"
Tc=5.0 min CN=83.0/98.0 Runoff=0.42 cfs 0.141 af

Subcatchment OVSR: Offsite Residential - Runoff Area=244,726 sf 0.00% Impervious Runoff Depth=2.11"
Tc=25.0 min CN=83.0/0.0 Runoff=2.14 cfs 0.990 af

Subcatchment OVSRW: Offsite (ROW Runoff Area=62,071 sf 79.42% Impervious Runoff Depth=3.22"
Tc=10.0 min CN=80.0/98.0 Runoff=1.08 cfs 0.382 af

Subcatchment OVWL: Offsite pervious - Runoff Area=97,317 sf 100.00% Impervious Runoff Depth=3.57"
Tc=15.0 min CN=0.0/98.0 Runoff=1.77 cfs 0.664 af

Subcatchment OVWPL: Offsite - Runoff Area=115,995 sf 92.63% Impervious Runoff Depth=3.44"
Tc=5.0 min CN=80.0/98.0 Runoff=2.28 cfs 0.764 af

Subcatchment OVWR: Offsite Impervious Runoff Area=67,651 sf 100.00% Impervious Runoff Depth=3.57"
Tc=15.0 min CN=0.0/98.0 Runoff=1.23 cfs 0.461 af

Subcatchment P: Payne Road - future Runoff Area=14,218 sf 69.05% Impervious Runoff Depth=3.19"
Tc=0.0 min CN=86.0/98.0 Runoff=0.27 cfs 0.087 af

Subcatchment RP1: Lot 1 and 5 (roofs) Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=3.57"
Tc=5.0 min CN=0.0/98.0 Runoff=0.27 cfs 0.089 af

Subcatchment WAB: Wetland A Buffer Runoff Area=2.000 ac 0.00% Impervious Runoff Depth=1.95"
Tc=10.0 min CN=81.0/0.0 Runoff=0.87 cfs 0.326 af

Pond A-1: MH A2 TO MH A1A & MH A1B Peak Elev=200.83' Inflow=11.43 cfs 4.312 af
Primary=5.71 cfs 2.156 af Secondary=5.71 cfs 2.156 af Outflow=11.43 cfs 4.312 af

Pond A-2: MH A3 TO MH A2 Peak Elev=201.26' Inflow=0.72 cfs 0.240 af
10.0" Round Culvert n=0.013 L=143.6' S=0.0079 '/' Outflow=0.72 cfs 0.240 af

Pond A-3: PF-15 Pittock Pl. Peak Elev=201.91' Inflow=0.72 cfs 0.240 af
10.0" Round Culvert n=0.013 L=112.6' S=0.0050 '/' Outflow=0.72 cfs 0.240 af

Pond A1A: Stilling Well 1 Peak Elev=192.87' Storage=614 cf Inflow=6.13 cfs 2.297 af
24.0" Round Culvert n=0.013 L=2.0' S=0.0000 '/' Outflow=6.12 cfs 2.289 af

Pond B-1: MH B1 - CMD and Village (MH B1 TO MH A2) Peak Elev=216.66' Inflow=9.54 cfs 3.668 af
18.0" Round Culvert n=0.013 L=188.8' S=0.0188 '/' Outflow=9.54 cfs 3.668 af

Pond B-2: MH B2 to MH B1 Peak Elev=216.72' Inflow=0.89 cfs 0.321 af
12.0" Round Culvert n=0.013 L=67.0' S=0.0096 '/' Outflow=0.89 cfs 0.321 af

Pond B-4: MH B4 to MH B1 Peak Elev=216.94' Inflow=3.19 cfs 1.372 af
18.0" Round Culvert n=0.013 L=61.5' S=0.0133 '/' Outflow=3.19 cfs 1.372 af

Pond P-1: MH B3 to MH B1 Peak Elev=222.63' Inflow=0.27 cfs 0.087 af
12.0" Round Culvert n=0.013 L=222.0' S=0.0339 '/' Outflow=0.27 cfs 0.087 af

Pond P-2: MH P1 TO MH B3 Peak Elev=229.27' Inflow=0.27 cfs 0.087 af
12.0" Round Culvert n=0.013 L=116.7' S=0.0552 '/' Outflow=0.27 cfs 0.087 af

Pond PF-P: Perk Filter Payne Peak Elev=229.40' Inflow=0.27 cfs 0.087 af
10.0" Round Culvert n=0.013 L=9.0' S=0.0056 '/' Outflow=0.27 cfs 0.087 af

Pond PF14: Perk Filter 14 to MH A2 Peak Elev=213.42' Inflow=0.73 cfs 0.247 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0080 '/' Outflow=0.73 cfs 0.247 af

Pond PF15: PF-15 Pittock Pl. Peak Elev=201.96' Inflow=0.45 cfs 0.152 af
10.0" Round Culvert n=0.013 L=1.0' S=0.0500 '/' Outflow=0.45 cfs 0.152 af

Pond PF16: Perk Filter #16 Peak Elev=196.11' Inflow=0.42 cfs 0.141 af
8.0" Round Culvert n=0.013 L=9.5' S=0.7137 '/' Outflow=0.42 cfs 0.141 af

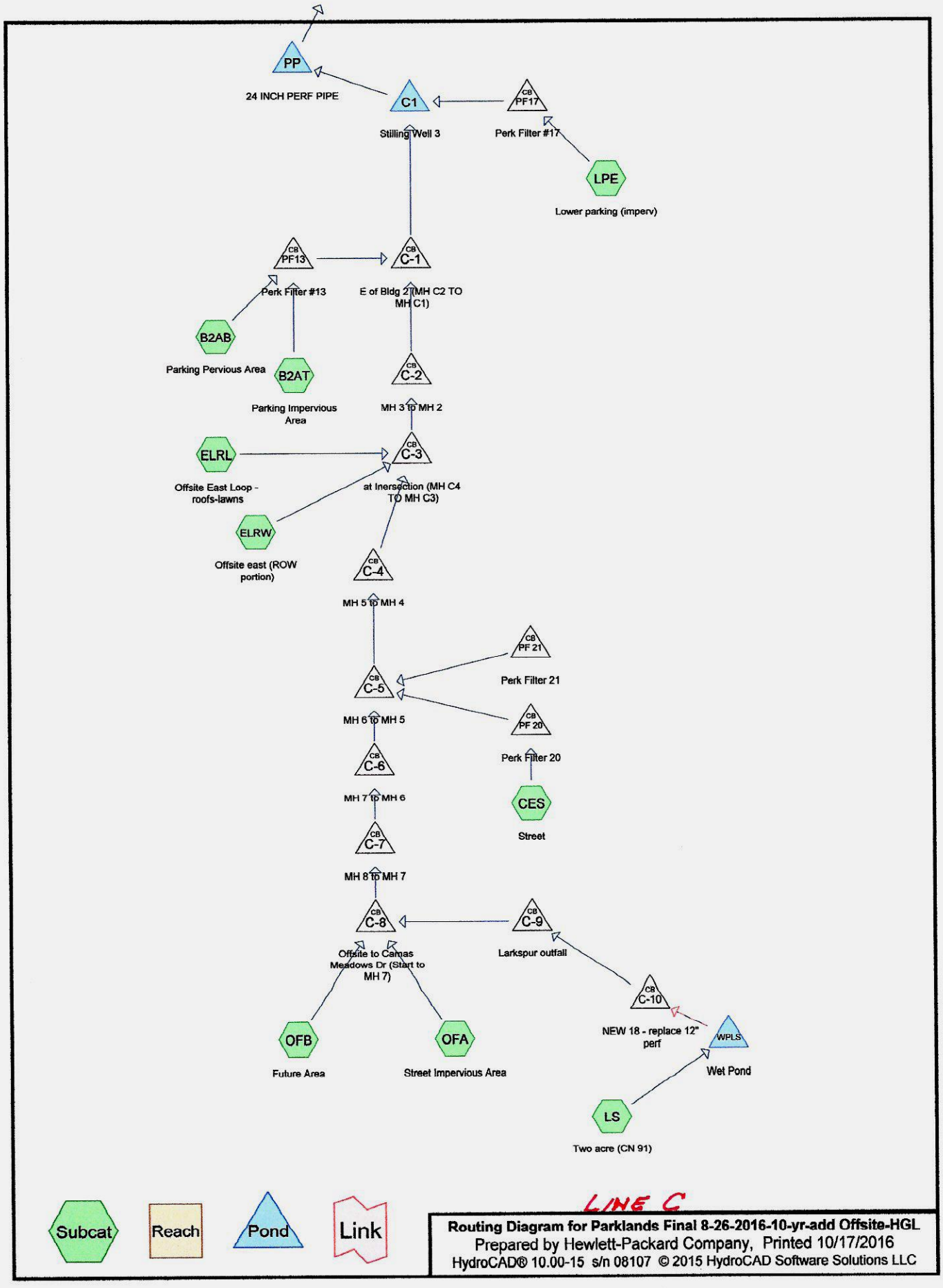
Pond PF18: Perk Filter 18 Peak Elev=217.05' Inflow=0.50 cfs 0.181 af
10.0" Round Culvert n=0.013 L=28.0' S=0.0339 '/' Outflow=0.50 cfs 0.181 af

Pond PF19: Perk Filter 19 Peak Elev=217.01' Inflow=0.39 cfs 0.140 af
10.0" Round Culvert n=0.013 L=28.0' S=0.0339 '/' Outflow=0.39 cfs 0.140 af

Pond PP: 24 INCH PERF PIPE Peak Elev=192.53' Storage=0.004 af Inflow=28.77 cfs 11.360 af
Outflow=28.76 cfs 11.360 af

Pond SW2: A1B

Peak Elev=192.70' Storage=218 cf Inflow=5.71 cfs 2.156 af
24.0" Round Culvert n=0.013 L=2.0' S=0.0000 '/' Outflow=5.71 cfs 2.152 af


PP
24 INCH PERF PIPE
C1
Stilling Well 3
CB PF17
Perk Filter #17
LPE
Lower parking (imperv)
CB PF13
Perk Filter #13
CB C-1
E of Bldg 2 (MH C2 TO MH C1)
B2AB
Parking Pervious Area
B2AT
Parking Impervious Area
CB C-2
MH 3 to MH 2
ELRL
Offsite East Loop - roofs-lawns
CB C-3
at Inersection (MH C4 TO MH C3)
ELRW
Offsite east (ROW portion)
CB C-4
MH 5 to MH 4
CB PF 21
Perk Filter 21
CB C-5
CB PF 20
Perk Filter 20
MH 6 to MH 5
CB C-6
CES
Street
MH 7 to MH 6
CB C-7
MH 8 to MH 7
CB C-8
CB C-9
Offsite to Camas Meadows Dr (Start to MH 7)
Larkspur outfall
CB C-10
NEW 18 - replace 12" perf
WPLS
Wet Pond
OFB
Future Area
OFA
Street Impervious Area
LS
Two acre (CN 91)
Subcat
Reach
Pond
Link
LINE C
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/17/2016
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Parklands Final 8-26-2016-10-yr-add Offsite-HGL
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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	C-1	200.80	189.00	158.5	0.0744	0.013	18.0	0.0	0.0
2	C-10	238.75	237.68	163.4	0.0065	0.013	18.0	0.0	0.0
3	C-2	219.88	201.00	134.0	0.1409	0.013	18.0	0.0	0.0
4	C-3	220.21	220.08	55.6	0.0023	0.013	30.0	0.0	0.0
5	C-4	220.90	220.41	96.4	0.0051	0.013	30.0	0.0	0.0
6	C-5	221.74	221.10	118.1	0.0054	0.013	30.0	0.0	0.0
7	C-6	224.52	221.94	149.8	0.0172	0.013	30.0	0.0	0.0
8	C-7	228.59	224.72	166.3	0.0233	0.013	24.0	0.0	0.0
9	C-8	237.25	228.79	200.0	0.0423	0.013	24.0	0.0	0.0
10	C-9	237.68	237.25	121.7	0.0035	0.013	18.0	0.0	0.0
11	C1	192.00	192.00	2.0	0.0000	0.013	24.0	0.0	0.0
12	PF 20	225.19	224.01	21.8	0.0541	0.013	10.0	0.0	0.0
13	PF 21	226.02	223.99	21.8	0.0931	0.013	10.0	0.0	0.0
14	PF13	211.87	206.00	63.5	0.0924	0.013	8.0	0.0	0.0
15	PF17	199.05	190.22	16.4	0.5384	0.013	8.0	0.0	0.0
16	WPLS	239.08	238.92	112.6	0.0014	0.013	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond C-1: E of Bldg 2 (MH C2 TO MH C1) Peak Elev=205.33' Inflow=16.54 cfs 6.783 af
18.0" Round Culvert n=0.013 L=158.5' S=0.0744 '/' Outflow=16.54 cfs 6.783 af

Pond C-10: NEW 18 - replace 12" perf Peak Elev=239.68' Inflow=2.46 cfs 1.701 af
18.0" Round Culvert n=0.013 L=163.4' S=0.0065 '/' Outflow=2.46 cfs 1.701 af

Pond C-2: MH 3 to MH 2 Peak Elev=224.20' Inflow=16.08 cfs 6.624 af
18.0" Round Culvert n=0.013 L=134.0' S=0.1409 '/' Outflow=16.08 cfs 6.624 af

Pond C-3: at Inersection (MH C4 TO MH C3) Peak Elev=224.66' Inflow=16.08 cfs 6.624 af
30.0" Round Culvert n=0.013 L=55.6' S=0.0023 '/' Outflow=16.08 cfs 6.624 af

Pond C-4: MH 5 to MH 4 Peak Elev=224.99' Inflow=14.11 cfs 5.804 af
30.0" Round Culvert n=0.013 L=96.4' S=0.0051 '/' Outflow=14.11 cfs 5.804 af

Pond C-5: MH 6 to MH 5 Peak Elev=225.31' Inflow=14.11 cfs 5.804 af
30.0" Round Culvert n=0.013 L=118.1' S=0.0054 '/' Outflow=14.11 cfs 5.804 af

Pond C-6: MH 7 to MH 6 Peak Elev=226.28' Inflow=13.20 cfs 5.477 af
30.0" Round Culvert n=0.013 L=149.8' S=0.0172 '/' Outflow=13.20 cfs 5.477 af

Pond C-7: MH 8 to MH 7 Peak Elev=230.35' Inflow=13.20 cfs 5.477 af
24.0" Round Culvert n=0.013 L=166.3' S=0.0233 '/' Outflow=13.20 cfs 5.477 af

Pond C-8: Offsite to Camas Meadows Dr (Start to MH 7) Peak Elev=239.01' Inflow=13.20 cfs 5.477 af
24.0" Round Culvert n=0.013 L=200.0' S=0.0423 '/' Outflow=13.20 cfs 5.477 af

Pond C-9: Larkspur outfall Peak Elev=239.13' Inflow=2.46 cfs 1.701 af
18.0" Round Culvert n=0.013 L=121.7' S=0.0035 '/' Outflow=2.46 cfs 1.701 af

Pond C1: Stilling Well 3 Peak Elev=193.64' Storage=0.006 af Inflow=16.95 cfs 6.924 af
24.0" Round Culvert x 2.00 n=0.013 L=2.0' S=0.0000 '/' Outflow=16.95 cfs 6.920 af

Pond PF 20: Perk Filter 20 Peak Elev=225.56' Inflow=0.43 cfs 0.155 af
10.0" Round Culvert n=0.013 L=21.8' S=0.0541 '/' Outflow=0.43 cfs 0.155 af

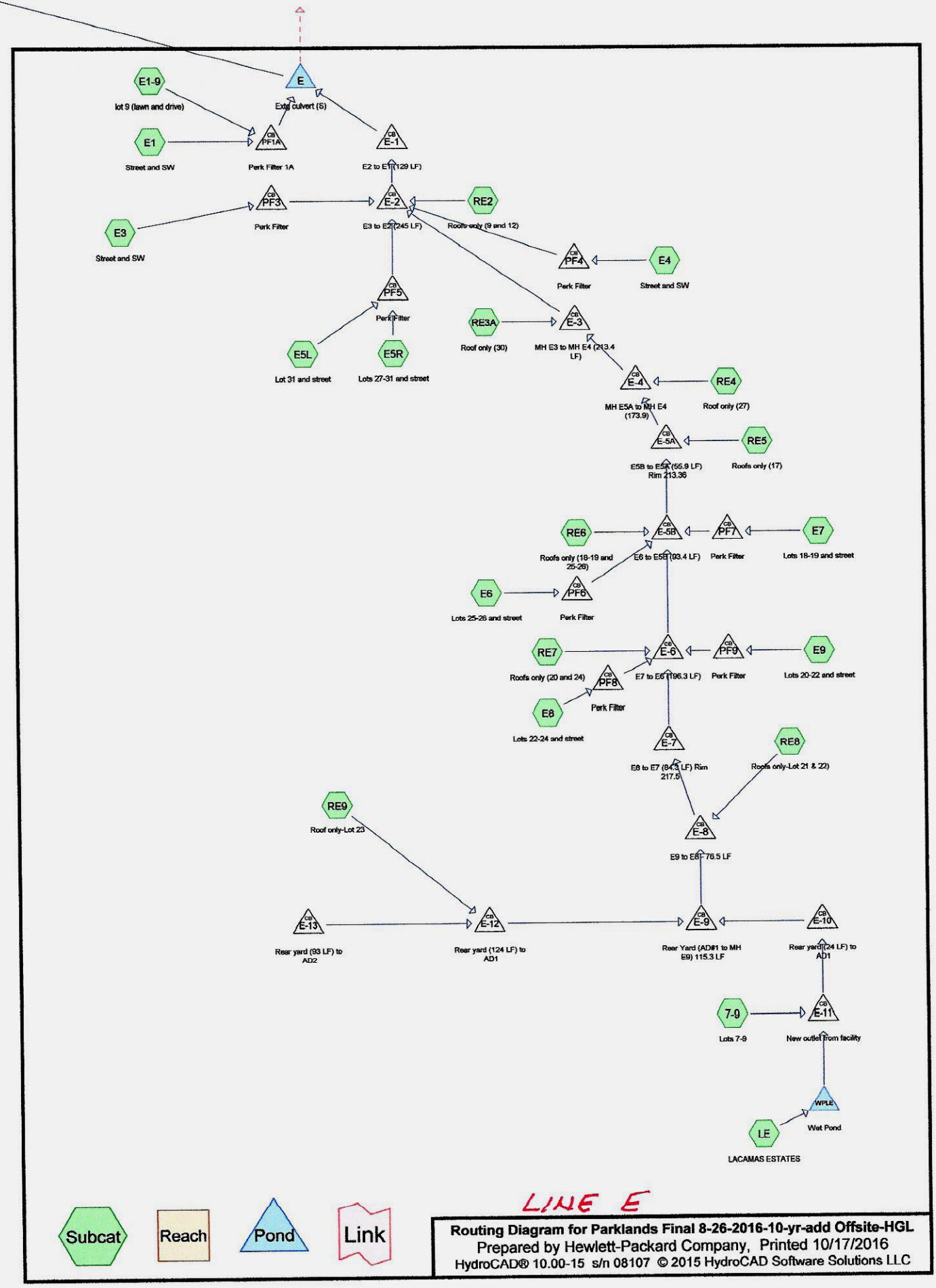
Pond PF 21: Perk Filter 21 Peak Elev=226.39' Inflow=0.48 cfs 0.172 af
10.0" Round Culvert n=0.013 L=21.8' S=0.0931 '/' Outflow=0.48 cfs 0.172 af

Pond PF13: Perk Filter #13 Peak Elev=212.27' Inflow=0.47 cfs 0.160 af
8.0" Round Culvert n=0.013 L=63.5' S=0.0924 '/' Outflow=0.47 cfs 0.160 af

Pond PF17: Perk Filter #17 Peak Elev=199.43' Inflow=0.42 cfs 0.141 af
8.0" Round Culvert n=0.013 L=16.4' S=0.5384 '/' Outflow=0.42 cfs 0.141 af

Pond PP: 24 INCH PERF PIPE Peak Elev=192.53' Storage=0.004 af Inflow=28.77 cfs 11.360 af
Outflow=28.76 cfs 11.360 af

Pond WPLS: Wet Pond Peak Elev=240.69' Storage=30,840 cf Inflow=4.26 cfs 1.607 af
Primary=2.46 cfs 1.701 af Secondary=0.00 cfs 0.000 af Outflow=2.46 cfs 1.701 af



LINE E

Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/17/2016
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Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	E	187.47	187.47	30.0	0.0000	0.013	24.0	0.0	0.0
2	E	187.98	186.06	43.0	0.0447	0.013	24.0	0.0	0.0
3	E-1	190.00	187.98	129.1	0.0156	0.013	18.0	0.0	0.0
4	E-10	216.00	215.85	25.0	0.0060	0.013	15.0	0.0	0.0
5	E-11	218.62	217.00	14.0	0.1157	0.013	12.0	0.0	0.0
6	E-12	216.00	215.50	124.0	0.0040	0.013	12.0	0.0	0.0
7	E-13	226.00	216.00	94.8	0.1055	0.013	12.0	0.0	0.0
8	E-2	198.09	190.20	244.9	0.0322	0.013	18.0	0.0	0.0
9	E-3	205.00	198.29	213.4	0.0314	0.013	18.0	0.0	0.0
10	E-4	207.90	205.20	173.9	0.0155	0.013	18.0	0.0	0.0
11	E-5A	208.80	208.10	55.9	0.0125	0.013	18.0	0.0	0.0
12	E-5B	210.15	209.00	93.4	0.0123	0.013	18.0	0.0	0.0
13	E-6	212.15	210.35	196.3	0.0092	0.013	15.0	0.0	0.0
14	E-7	213.00	212.35	84.3	0.0077	0.013	15.0	0.0	0.0
15	E-8	214.00	213.00	76.5	0.0131	0.013	15.0	0.0	0.0
16	E-9	215.50	214.00	115.3	0.0130	0.013	15.0	0.0	0.0
17	PF1A	188.52	187.47	26.0	0.0404	0.013	8.0	0.0	0.0
18	PF3	199.47	199.40	15.0	0.0047	0.013	8.0	0.0	0.0
19	PF4	198.38	198.33	10.0	0.0050	0.013	8.0	0.0	0.0
20	PF5	198.41	198.29	13.0	0.0092	0.013	8.0	0.0	0.0
21	PF6	210.21	210.15	12.0	0.0050	0.013	8.0	0.0	0.0
22	PF7	210.21	210.15	10.0	0.0060	0.013	8.0	0.0	0.0
23	PF8	212.21	212.15	12.0	0.0050	0.013	8.0	0.0	0.0
24	PF9	212.21	212.15	10.0	0.0060	0.013	8.0	0.0	0.0
25	WPLE	222.68	222.53	6.5	0.0231	0.013	12.0	0.0	0.0

Pond PF3: Perk Filter Peak Elev=200.66' Inflow=0.28 cfs 0.094 af
8.0" Round Culvert n=0.013 L=15.0' S=0.0047 '/' Outflow=0.28 cfs 0.094 af

Pond PF4: Perk Filter Peak Elev=200.68' Inflow=0.38 cfs 0.129 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0050 '/' Outflow=0.38 cfs 0.129 af

Pond PF5: Perk Filter Peak Elev=201.02' Inflow=1.05 cfs 0.398 af
8.0" Round Culvert n=0.013 L=13.0' S=0.0092 '/' Outflow=1.05 cfs 0.398 af

Pond PF6: Perk Filter Peak Elev=211.34' Inflow=0.30 cfs 0.114 af
8.0" Round Culvert n=0.013 L=12.0' S=0.0050 '/' Outflow=0.30 cfs 0.114 af

Pond PF7: Perk Filter Peak Elev=211.34' Inflow=0.30 cfs 0.114 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0060 '/' Outflow=0.30 cfs 0.114 af

Pond PF8: Perk Filter Peak Elev=213.33' Inflow=0.32 cfs 0.122 af
8.0" Round Culvert n=0.013 L=12.0' S=0.0050 '/' Outflow=0.32 cfs 0.122 af

Pond PF9: Perk Filter Peak Elev=213.33' Inflow=0.32 cfs 0.122 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0060 '/' Outflow=0.32 cfs 0.122 af

Pond WPLE: Wet Pond Peak Elev=224.15' Storage=36,836 cf Inflow=4.63 cfs 1.743 af
12.0" Round Culvert n=0.013 L=6.5' S=0.0231 '/' Outflow=2.94 cfs 1.741 af

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond E: Extg culvert (S) Peak Elev=188.99' Storage=37 cf Inflow=11.62 cfs 4.971 af
Primary=6.74 cfs 3.816 af Secondary=4.89 cfs 1.155 af Outflow=11.62 cfs 4.971 af

Pond E-1: E2 to E1 (129 LF) Peak Elev=192.54' Inflow=11.40 cfs 4.892 af
18.0" Round Culvert n=0.013 L=129.1' S=0.0156 '/' Outflow=11.40 cfs 4.892 af

Pond E-10: Rear yard (24 LF) to AD1 Peak Elev=217.11' Inflow=3.24 cfs 1.905 af
15.0" Round Culvert n=0.013 L=25.0' S=0.0060 '/' Outflow=3.24 cfs 1.905 af

Pond E-11: New outlet from facility Peak Elev=219.86' Inflow=3.24 cfs 1.905 af
12.0" Round Culvert n=0.013 L=14.0' S=0.1157 '/' Outflow=3.24 cfs 1.905 af

Pond E-12: Rear yard (124 LF) to AD1 Peak Elev=216.46' Inflow=0.13 cfs 0.044 af
12.0" Round Culvert n=0.013 L=124.0' S=0.0040 '/' Outflow=0.13 cfs 0.044 af

Pond E-13: Rear yard (93 LF) to AD2 Peak Elev=0.00'
12.0" Round Culvert n=0.013 L=94.8' S=0.1055 '/' Primary=0.00 cfs 0.000 af

Pond E-2: E3 to E2 (245 LF) Peak Elev=200.63' Inflow=11.40 cfs 4.892 af
18.0" Round Culvert n=0.013 L=244.9' S=0.0322 '/' Outflow=11.40 cfs 4.892 af

Pond E-3: MH E3 to MH E4 (213.4 LF) Peak Elev=206.67' Inflow=8.17 cfs 3.742 af
18.0" Round Culvert n=0.013 L=213.4' S=0.0314 '/' Outflow=8.17 cfs 3.742 af

Pond E-4: MH E5A to MH E4 (173.9) Peak Elev=209.10' Inflow=5.64 cfs 2.864 af
18.0" Round Culvert n=0.013 L=173.9' S=0.0155 '/' Outflow=5.64 cfs 2.864 af

Pond E-5A: E5B to E5A (55.9 LF) Rim 213.36 Peak Elev=210.00' Inflow=5.52 cfs 2.820 af
18.0" Round Culvert n=0.013 L=55.9' S=0.0125 '/' Outflow=5.52 cfs 2.820 af

Pond E-5B: E6 to E5B (93.4 LF) Peak Elev=211.31' Inflow=5.39 cfs 2.775 af
18.0" Round Culvert n=0.013 L=93.4' S=0.0123 '/' Outflow=5.39 cfs 2.775 af

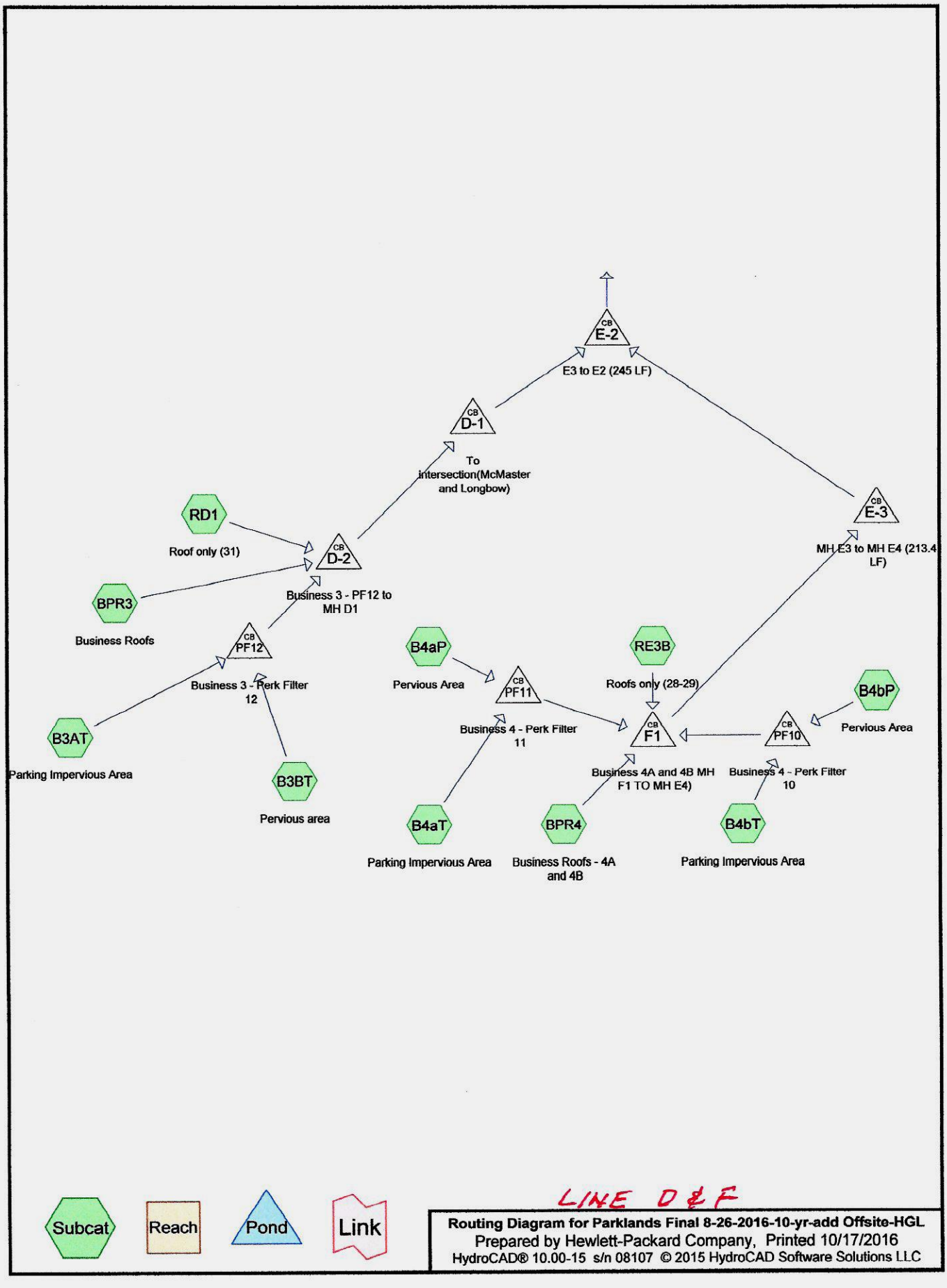
Pond E-6: E7 to E6 (196.3 LF) Peak Elev=213.29' Inflow=4.29 cfs 2.370 af
15.0" Round Culvert n=0.013 L=196.3' S=0.0092 '/' Outflow=4.29 cfs 2.370 af

Pond E-7: E8 to E7 (84.3 LF) Rim 217.5 Peak Elev=214.09' Inflow=3.46 cfs 2.038 af
15.0" Round Culvert n=0.013 L=84.3' S=0.0077 '/' Outflow=3.46 cfs 2.038 af

Pond E-8: E9 to E8 - 76.5 LF Peak Elev=215.01' Inflow=3.46 cfs 2.038 af
15.0" Round Culvert n=0.013 L=76.5' S=0.0131 '/' Outflow=3.46 cfs 2.038 af

Pond E-9: Rear Yard (AD#1 to MH E9) 115.3 LF Peak Elev=216.45' Inflow=3.31 cfs 1.949 af
15.0" Round Culvert n=0.013 L=115.3' S=0.0130 '/' Outflow=3.31 cfs 1.949 af

Pond PF1A: Perk Filter 1A Peak Elev=189.04' Inflow=0.23 cfs 0.079 af
8.0" Round Culvert n=0.013 L=26.0' S=0.0404 '/' Outflow=0.23 cfs 0.079 af


CB E-2
E3 to E2 (245 LF)
CB D-1
To intersection(McMaster and Longbow)
RD1
Roof only (31)
CB D-2
CB E-3
MH E3 to MH E4 (213.4 LF)
BPR3
Business Roofs
Business 3 - PF12 to MH D1
CB PF12
Business 3 - Perk Filter 12
B4aP
Pervious Area
CB PF11
RE3B
Roofs only (28-29)
B4bP
Pervious Area
B3AT
Parking Impervious Area
Business 4 - Perk Filter 11
CB F1
CB PF10
B3BT
Pervious area
Business 4A and 4B MH F1 TO MH E4)
Business 4 - Perk Filter 10
B4aT
Parking Impervious Area
BPR4
Business Roofs - 4A and 4B
B4bT
Parking Impervious Area
Subcat
Reach
Pond
Link
LINE D & F
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/17/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company
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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	D-1	200.00	198.29	135.8	0.0126	0.013	12.0	0.0	0.0
2	D-2	215.79	200.64	138.0	0.1098	0.013	10.0	0.0	0.0
3	E-2	198.09	190.20	244.9	0.0322	0.013	18.0	0.0	0.0
4	E-3	205.00	198.29	213.4	0.0314	0.013	18.0	0.0	0.0
5	F1	215.45	205.29	180.7	0.0562	0.013	12.0	0.0	0.0
6	PF10	220.90	215.55	85.6	0.0625	0.013	10.0	0.0	0.0
7	PF11	220.68	215.55	125.6	0.0408	0.013	10.0	0.0	0.0
8	PF12	215.79	215.78	1.0	0.0100	0.013	10.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond D-1: To intersection(McMaster and Longbow) Peak Elev=200.96' Inflow=1.31 cfs 0.441 af
12.0" Round Culvert n=0.013 L=135.8' S=0.0126 '/' Outflow=1.31 cfs 0.441 af

Pond D-2: Business 3 - PF12 to MH D1 Peak Elev=216.46' Inflow=1.31 cfs 0.441 af
10.0" Round Culvert n=0.013 L=138.0' S=0.1098 '/' Outflow=1.31 cfs 0.441 af

Pond E-2: E3 to E2 (245 LF) Peak Elev=200.63' Inflow=11.40 cfs 4.892 af
18.0" Round Culvert n=0.013 L=244.9' S=0.0322 '/' Outflow=11.40 cfs 4.892 af

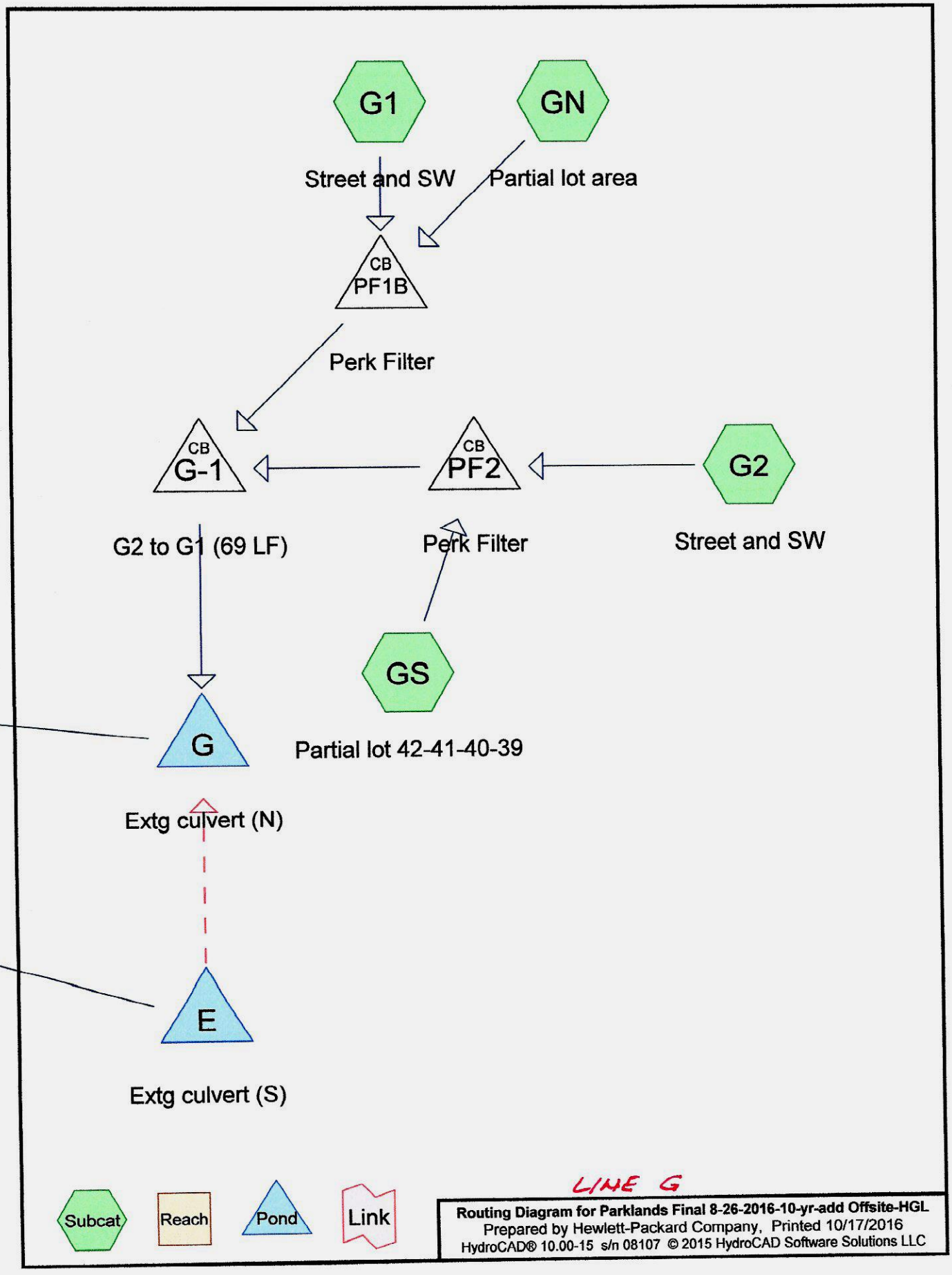
Pond E-3: MH E3 to MH E4 (213.4 LF) Peak Elev=206.67' Inflow=8.17 cfs 3.742 af
18.0" Round Culvert n=0.013 L=213.4' S=0.0314 '/' Outflow=8.17 cfs 3.742 af

Pond F1: Business 4A and 4B MH F1 TO MH E4) Peak Elev=216.37' Inflow=2.48 cfs 0.834 af
12.0" Round Culvert n=0.013 L=180.7' S=0.0562 '/' Outflow=2.48 cfs 0.834 af

Pond PF10: Business 4 - Perk Filter 10 Peak Elev=221.41' Inflow=0.84 cfs 0.281 af
10.0" Round Culvert n=0.013 L=85.6' S=0.0625 '/' Outflow=0.84 cfs 0.281 af

Pond PF11: Business 4 - Perk Filter 11 Peak Elev=221.16' Inflow=0.76 cfs 0.253 af
10.0" Round Culvert n=0.013 L=125.6' S=0.0408 '/' Outflow=0.76 cfs 0.253 af

Pond PF12: Business 3 - Perk Filter 12 Peak Elev=216.54' Inflow=0.73 cfs 0.247 af
10.0" Round Culvert n=0.013 L=1.0' S=0.0100 '/' Outflow=0.73 cfs 0.247 af


G1
GN
Street and SW
Partial lot area
CB
PF1B
Perk Filter
CB
G-1
CB
PF2
G2
G2 to G1 (69 LF)
Perk Filter
Street and SW
GS
G
Partial lot 42-41-40-39
Extg culvert (N)
E
Extg culvert (S)
Subcat
Reach
Pond
Link
LINE G
Routing Diagram for Parklands Final 8-26-2016-10-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/17/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	E	187.47	187.47	30.0	0.0000	0.013	24.0	0.0	0.0
2	E	187.98	186.06	43.0	0.0447	0.013	24.0	0.0	0.0
3	G	186.06	186.06	15.0	0.0000	0.013	24.0	0.0	0.0
4	G-1	186.34	186.07	63.8	0.0042	0.011	12.0	0.0	0.0
5	PF1B	186.50	186.34	19.0	0.0084	0.013	6.0	0.0	0.0
6	PF2	186.41	186.34	18.0	0.0039	0.013	6.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond E: Extg culvert (S) Peak Elev=188.99' Storage=37 cf Inflow=11.62 cfs 4.971 af
Primary=6.74 cfs 3.816 af Secondary=4.89 cfs 1.155 af Outflow=11.62 cfs 4.971 af

Pond G: Extg culvert (N) Peak Elev=188.32' Storage=42 cf Inflow=7.84 cfs 2.641 af
24.0" Round Culvert n=0.013 L=15.0' S=0.0000 '/' Outflow=7.84 cfs 2.640 af

Pond G-1: G2 to G1 (69 LF) Peak Elev=188.40' Inflow=1.18 cfs 0.414 af
12.0" Round Culvert n=0.011 L=63.8' S=0.0042 '/' Outflow=1.18 cfs 0.414 af

Pond PF1B: Perk Filter Peak Elev=188.93' Inflow=0.68 cfs 0.237 af
6.0" Round Culvert n=0.013 L=19.0' S=0.0084 '/' Outflow=0.68 cfs 0.237 af

Pond PF2: Perk Filter Peak Elev=188.68' Inflow=0.51 cfs 0.177 af
6.0" Round Culvert n=0.013 L=18.0' S=0.0039 '/' Outflow=0.51 cfs 0.177 af

APPENDIX D CONVEYANCE SYSTEM
APPENDIX D-2 CONVEYANCE DESIGN COMMENTS

7.1 Design and Construction Standards

Minimum Pipe Diameter (7.2)

- *Public mainline storm sewers shall be a minimum of twelve (12) inches inside diameter. Downstream pipe diameters shall not be reduced except when approved by the City.*
  - **Condition met on public and private streets. The exception is Longbow Ln where grade restrictions necessitate a smaller pipe size.**
- *Public storm sewer laterals shall be ten (10) inches inside diameter. Larger pipe diameter may be used with large capacity catch basins and when approved by the City.*

- **There are several 6 and 8 inch laterals from the Perk Filter systems. The inflow is small due to the closer spacing along the main pipe runs and there are elevation constraints. In particular along Longbow Ln.**

7.5 Hydraulic Methods

"Two hydraulic methods can be used for the design of pipelines. The first method is a gravity flow or open channel design, which is most commonly performed using Manning's equation. This method assumes that flow is steady (does not change with time) and uniform (the depth and velocity remain constant throughout the pipe for a given flow). Manning's equation can be found in standard hydraulic textbooks and in the WSDOT Hydraulics Manual (WSDOT 2007)."

- **Gravity flow or open channel design, using Manning's equation was applied in this design.**
- **However, the existing culverts from Wetland B to C required a dynamic flow analysis which is an option with HydroCAD. Pipe run input can be converted to the pond symbol and the analysis accounts for downstream (or tailwater elevations).**

"The second method is a pressure flow design, where the water surface elevation rises above the crown of the pipe. A backwater analysis is performed to determine the level of the water surface (the hydraulic grade line) for a pipeline system with a given diameter, slope, and flow rate. This method also assumes steady flow, but the flow is not necessarily uniform (the slope of the hydraulic grade line differs from the slope of the pipe).

New pipes shall be designed to operate in an open-channel regime during the design storm and shall be sized using open channel design methods. Under certain hydrologic and

APPENDIX D CONVEYANCE SYSTEM
APPENDIX D-2 CONVEYANCE DESIGN COMMENTS

hydraulic conditions, however, flow can rise above the pipe, creating a pressurized pipeline. For those situations, it is important to determine the hydraulic grade line to ensure that water does not overtop manholes and catch basins. A backwater analysis shall be calculated under any of the following conditions:"

- *Pipes with slopes less than 0.50 percent.*
  - **A 10-yr analysis was performed to check open channel flow conditions. See Appendix D-1.**
  - **However, the 100-yr analysis required a pressure flow analysis to account for losses due to high velocity conditions. Pipes were upsized accordingly.**
- *Pipes with velocities over 6.5 feet per second (fps) (for subcritical flow only).*
  - **There are several pipes with velocities above this rate – flow control manholes have been designed to account (suppress the energy) for downstream system impacts.**
- *Inlet and outlet pipes forming a sharp angle (45 degrees or greater) at junctions.*
  - **There are several laterals with this condition, but the main pipe system has capacity to account for these minor losses.**
- *Pipe inverts less than three (3) feet deep when entering and leaving junctions.*
  - **No situations where pipe invert depths are less than three (3) feet.**

"When using Manning's equation for the design, each pipe within the system shall be sized *and sloped such that its barrel capacity at normal full flow is equal to or greater than the required conveyance capacity for the peak runoff of the design storm. A Manning's "N" of 0.013 shall be used for all pipes in Table 7-1. Table 7-2 provides the allowable minimum pipe slope and associated design capacity."*

- **The design storm is for a 10-yr event. The capacity check was made for the 10-yr event in Appendix D-1. The main system is sized to convey the 10-yr in open channel conditions to the last pipe segments where flow energy reduction systems produce minor backwater situations.**

APPENDIX D CONVEYANCE SYSTEM
D-3 STORM SYSTEM PIPE CAPACITY
AND 100-YR HGL CHECK

Notes:

1. The storm systems are sized for open channel flow - 10-yr event. However, velocity head losses create a backwater condition which was tabulated for the 10-yr event.

2. This tabulation for the 100-yr event indicates the storm systems are adequate in managing the 100-yr event as well. See MH C6 which has 0.22 ft freeboard and represents the closed HGL to rim elevation relationship.

STORM LINE A & B														
Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	100-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
PF-P1	MH P1	PFP1	9.0	10	230.28	229.07	229.02	0.0056	0.39	1.63	229.47	0.40	0.83	OK
MH P1	MH B3	P-2	116.7	12	230.46	229.02	222.58	0.0552	0.39	8.40	229.33	0.31	1.00	OK
MH B3	MH B1	P-1	222.6	12	230.25	222.38	214.85	0.0338	0.39	6.56	222.69	0.31	1.00	OK
PF-18	MH B2	PF18	30.0	10	221.73	216.64	215.69	0.0317	0.73	4.04	218.42	1.78	0.83	submerged
PF-19	MH B2	PF19	30.0	10	221.73	216.64	215.69	0.0317	0.56	4.04	218.39	1.75	0.83	submerged
MH B2	MH B1	B-2	67.9	12	222.11	215.49	214.85	0.0094	1.30	3.48	218.35	2.86	1.00	submerged
MH B4	MH B1	B-4	61.5	18	229.98	215.67	214.85	0.0133	5.23	12.13	218.57	2.90	1.50	submerged
MH B1	MH A2	B-1	190.0	18	222.45	214.65	211.10	0.0187	14.22	14.4	218.19	3.54	1.50	submerged
PF-15	MH A3	A-3	112.6	10	205.36	201.36	200.80	0.0050	0.67	1.55	202.69	1.33	0.83	submerged
MH A3	MH A2	A-2	253.0	10	218.14	200.73	199.47	0.0050	1.04	1.94	202.64	1.91	0.83	submerged
MH A2	MH A1A	A-1A	184.0	15	218.95	199.37	188.00	0.0618	8.46	16.06	201.95	2.58	1.25	submerged
MH A2	MHA1B	A-1B	170.0	15	218.95	199.37	188.50	0.0639	8.46	16.33	201.95	2.58	1.25	submerged
MH A1B	MH C1	A1B-C1	180.0	24	200.70	191.50	192.00	-0.0028	28.77	11.97	192.53	1.03	2.00	OK
MH A1A	MH A1B	AIA-A1B	124.0	24	200.00	191.00	191.50	-0.0040	28.77	14.31	192.53	1.53	2.00	OK
PF-14	MH A2	B-1A	10.0	8	217.63	212.80	212.72	0.0080	1.05	1.08	213.63	0.83	0.67	submerged
PF-16	MH A1A	A-1C	9.5	8	200.56	195.73	189.67	0.6379	0.60	9.65	196.19	0.46	0.67	OK

APPENDIX D CONVEYANCE SYSTEM
D-3 STORM SYSTEM PIPE CAPACITY
AND 100-YR HGL CHECK

Storm System Line C														
Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
D1-1	Tee into C-10	C-11	13.0	15	243.08+/-	240.13	238.23	0.1462	no flow	24.7	no flow	---	---	---
Extg MH C11	MH C10	C-10	163.4	18	242.62	238.72	237.68	0.0064	3.26	8.38	240.13	1.41	1.50	OK
MH C10	MH C9	C-9	121.7	18	242.00	237.68	237.25	0.0035	3.26	6.24	239.9	2.22	1.50	OK
MH C9	MH C8	C-8	200.0	24	245.34	237.25	228.79	0.0423	18.78	46.53	239.79	2.54	2.00	submerged
MH C8	MH C7	C-7	166.3	24	236.46	228.59	224.72	0.0233	18.78	34.51	232.64	4.05	2.00	submerged
MH C7	MH C6	C-6	149.8	30	231.84	224.52	221.94	0.0172	18.78	53.83	230.94	6.42	2.50	submerged
PF-20	MH C6	C6-B	21.0	8	230.19	225.19	223.57	0.0771	0.43	5.10	225.56	0.37	0.67	OK
PF-21	MH C6	C-6A	21.0	8	230.19	225.19	223.57	0.0771	0.48	6.69	226.09	0.90	0.67	submerged
MH C6	MH C5	C-5	118.1	30	230.60	221.74	221.10	0.0054	20.1	30.19	230.38	8.64	2.50	submerged
MH C5	MH C4	C-4	96.4	30	231.17	220.90	220.41	0.0051	20.1	29.24	229.74	8.84	2.50	submerged
MH C4	MH C3	C-3	55.6	30	231.61	220.21	220.08	0.0023	23.25	19.83	229.06	8.85	2.50	submerged
MH C3	MH C2	C-2	134.0	18	228.35	219.88	201.00	0.1409	23.25	39.43	228.10	8.22	1.50	submerged
PF-13	MH C2	C-2A	63.5	8	216.70	211.87	206.00	0.0924	0.47	3.67	212.27	0.40	0.67	OK
MH C2	MH C1	C-1	158.5	18	210.80	200.80	189.00	0.0744	23.92	28.66	209.45	8.65	1.50	submerged
PF-17	MHC1	C-1A	16.4	8	203.88	199.05	190.22	0.5384	0.42	8.87	199.43	0.38	0.67	OK

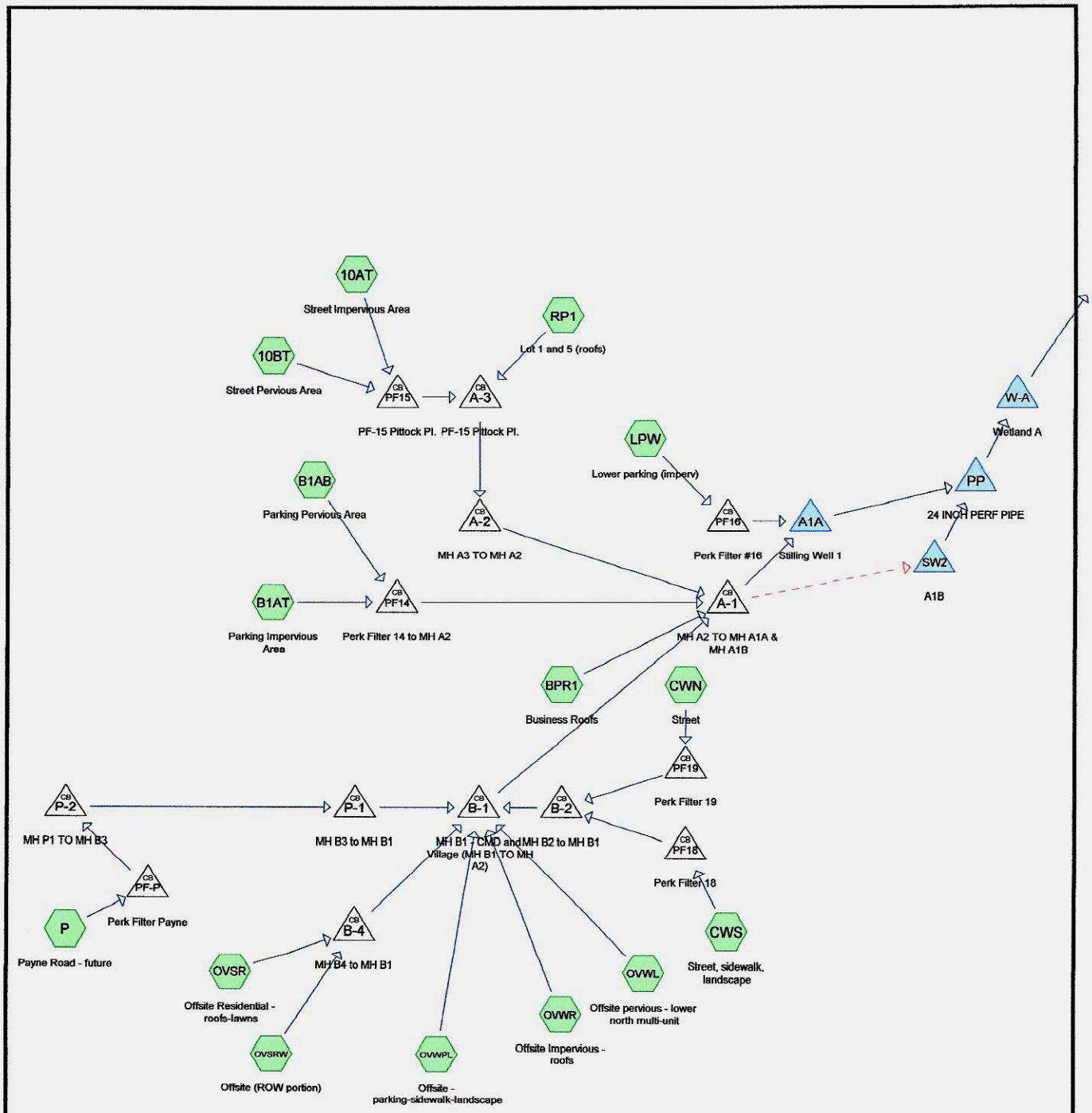
Storm System Line D, E, & F														
Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition
DI-2	Extg MH E10	E-12	15.0	15	224.78+/-	221.83	218.62	0.2140	no flow	29.88	no flow	---	1.25	no flow
Extg MH E10	AD4	E-11	14.0	12	221.88	218.62	217.00	0.1157	3.06	12.12	219.77	1.15	1.00	submerged
AD4	AD1	E-10	25.0	15	219.00	216.00	215.85	0.0060	3.06	7.37	217.07	1.07	1.25	OK
AD3	AD2	E-14	94.8	12	228.00	226.00	216.00	0.1055	GW flow ?	11.57	226.00	Min. Flow	1.00	OK
AD2	AD1	E-13	124.0	12	218.00	216.00	215.50	0.0040	0.20	2.26	216.48	0.48	1.00	OK
AD1	MH E9	E-9	115.3	15	218.00	215.50	214.00	0.0130	3.28	7.37	216.44	0.94	1.25	OK
MH E9	MH E8	E-8	76.5	15	219.24	214.00	213.00	0.0131	3.43	7.39	215.01	1.01	1.25	OK
MH E8	MH E7	E-7	84.3	15	217.50	213.00	212.35	0.0077	3.43	5.67	214.09	1.09	1.25	OK
PF-8	MH E7	E-7A	12.0	6	216.05	212.22	212.15	0.0058	0.32	0.85	213.34	1.12	0.50	submerged
PF-9	MH E7	E-7B	10.0	6	216.05	212.22	212.15	0.0070	0.32	0.94	213.34	1.12	0.50	submerged
MH E7	MH E6	E-6	196.3	15	216.29	212.15	210.35	0.0092	4.31	6.19	213.30	1.15	1.25	OK
PF-6	MH E6	PF5	12.0	6	214.04	210.79	210.15	0.0533	0.30	2.24	211.35	0.56	0.50	submerged
PF-7	MH E6	PF7	10.0	6	214.04	210.79	210.15	0.0640	0.30	2.39	211.35	0.56	0.50	submerged

APPENDIX D CONVEYANCE SYSTEM
D-3 STORM SYSTEM PIPE CAPACITY
AND 100-YR HGL CHECK

MH E6	MH E5B	E-5B	93.4	18	214.32	210.15	209.00	0.0123	5.42	10.59	211.32	1.17	1.50	OK	
MH E5B	MH E5A	E-5A	55.9	18	213.36	208.80	208.10	0.0125	5.55	27.39	210.01	1.21	1.50	OK	
MH E5A	MH E4	E-4	173.9	18	212.78	207.90	205.20	0.0155	5.67	20.63	209.10	1.20	1.50	OK	
PF-10	MH F1	F-2R	85.6	10	226.48	220.90	215.55	0.0625	0.84	5.48	221.41	0.51	0.83	OK	
PF-11	MH F1	F-2L	125.6	10	226.26	220.68	215.55	0.0408	0.76	4.43	221.16	0.48	0.83	OK	
MH F1	MH E4	F-1	180.7	12	219.53	215.45	205.29	0.0562	2.48	8.45	216.37	0.92	1.00	OK	
MH E4	MH E3	E-3	213.4	18	209.38	205.00	198.29	0.0314	8.2	18.63	206.68	1.68	1.50	submerged	
PF-3	MH E3	D-1A	17.0	8	203.47	200.05	198.84	0.0712	0.28	0.83	200.67	0.62	0.67	OK	
PF-4	MH E3	E-3A	10.0	8	203.56	200.14	199.71	0.0430	0.38	0.85	200.69	0.55	0.67	OK	
PF-5	MH E3	D-1B	13.0	8	203.20	198.41	198.29	0.0092	1.05	1.16	201.04	2.63	0.67	submerged	
PF-12	MH D2	D-2	138.0	10	215.79	215.79	200.64	0.1098	1.31	7.26	216.46	0.67	0.83	OK	
MH D2	MH E3	D-1	135.8	12	204.67	200.00	198.29	0.0126	1.31	4.00	200.97	0.97	1.00	OK	
MH E3	MH E2	E-2	244.9	18	203.49	198.09	190.20	0.0322	11.43	18.85	200.65	2.56	1.50	submerged	
MH E2	MH E1	E-1	129.1	18	193.30	190.00	187.98	0.0156	11.43	13.14	192.56	2.56	1.50	submerged	
PF-1A	MH E1	E-1A	26.0	8	191.94	188.52	187.47	0.0404	0.23	2.43	189.04	0.52	0.67	OK	
MH E1	OUTLET	W-1	30.0	24	190.86	187.47	187.47	0.0000	6.76	---	188.99	1.52	2.00	OK	6.75 fps
MH E1	MH G1	W-3	43.0	24	190.86	187.98	186.07	0.0444	4.91	47.67	189.99	2.01	2.00	submerged	4.46 fps

Storm System Line G

Upstream Structure ID	Downstream Structure ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Pipe Size (in)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Pipe Slope cntr to cntr (ft/ft)	10-YR Peak Rate (cfs)	Pipe Full Capacity (cfs)	Max. WSEL (ft)	Depth at Structure (ft)	Pipe Dia. (ft)	Remark on Hydraulic Condition	
PF-1B	MH G2	G-3	19.0	6	189.75	186.5	186.34	0.0084	0.68	0.51	188.93	2.43	0.50	submerged	
PF-2	MH G2	G-2	18.0	6	189.66	186.41	186.34	0.0039	0.51	0.35	188.68	2.27	0.50	submerged	
MH G2	MH G1	G-1	63.8	12	189.88	186.34	186.07	0.0042	1.18	2.32	188.40	2.06	1.00	submerged	
MH G1	OUTLET	W-2	14.7	24	190.37	186.07	186.06	0.0007	7.86	5.99	188.33	2.26	2.00	submerged	2.46 cfs


10AT
Street Impervious Area
RP1
Lot 1 and 5 (roofs)
10BT
Street Pervious Area
CB PF15
CB A-3
PF-15 Pittock Pl.
PF-15 Pittock Pl.
W-A
Wetland A
LPW
Lower parking (imperv)
B1AB
Parking Pervious Area
PP
24 INCH PERF PIPE
CB A-2
MH A3 TO MH A2
CB PF16
A1A
Perk Filter #16
Stilling Well 1
SW2
A1B
B1AT
Parking Impervious Area
CB PF14
Perk Filter 14 to MH A2
CB A-1
MH A2 TO MH A1A & MH A1B
BPR1
Business Roofs
CWN
Street
CB PF19
Perk Filter 19
CB P-2
CB P-1
CB B-1
CB B-2
MH P1 TO MH B3
MH B3 to MH B1
MH B1 - CMD and Village (MH B1 TO MH A2)
MH B2 to MH B1
CB PF18
Perk Filter 18
CB PF-P
Perk Filter Payne
P
Payne Road - future
CB B-4
MH B4 to MH B1
CWS
Street, sidewalk, landscape
OVSR
Offsite Residential - roofs-lawns
OVWL
Offsite pervious - lower north multi-unit
OVWR
Offsite Impervious - roofs
OVSRW
Offsite (ROW portion)
OVWPL
Offsite - parking-sidewalk-landscape
Subcat
Reach
Pond
Link
LINE A1B
Routing Diagram for Parklands Final 8-26-2016-100-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Parklands Final 8-26-2016-100-yr-add Offsite-HGL

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	A-1	199.27	188.00	183.6	0.0614	0.013	15.0	0.0	0.0
2	A-1	199.27	188.50	170.6	0.0631	0.013	15.0	0.0	0.0
3	A-2	200.60	199.47	143.6	0.0079	0.013	10.0	0.0	0.0
4	A-3	201.36	200.80	112.6	0.0050	0.013	10.0	0.0	0.0
5	A1A	191.50	191.50	2.0	0.0000	0.013	24.0	0.0	0.0
6	B-1	214.65	211.10	188.8	0.0188	0.013	18.0	0.0	0.0
7	B-2	215.49	214.85	67.0	0.0096	0.013	12.0	0.0	0.0
8	B-4	215.67	214.85	61.5	0.0133	0.013	18.0	0.0	0.0
9	P-1	222.38	214.85	222.0	0.0339	0.013	12.0	0.0	0.0
10	P-2	229.02	222.58	116.7	0.0552	0.013	12.0	0.0	0.0
11	PF-P	229.07	229.02	9.0	0.0056	0.013	10.0	0.0	0.0
12	PF14	212.80	212.72	10.0	0.0080	0.013	8.0	0.0	0.0
13	PF15	201.36	201.31	1.0	0.0500	0.013	10.0	0.0	0.0
14	PF16	195.73	188.95	9.5	0.7137	0.013	8.0	0.0	0.0
15	PF18	216.64	215.69	28.0	0.0339	0.013	10.0	0.0	0.0
16	PF19	216.64	215.69	28.0	0.0339	0.013	10.0	0.0	0.0
17	SW2	191.00	191.00	2.0	0.0000	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 10AT: Street Impervious Runoff Area=15,797 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.45 cfs 0.153 af

Subcatchment 10BT: Street Pervious Area Runoff Area=9,720 sf 0.00% Impervious Runoff Depth=3.75"
Tc=5.0 min CN=86.0/0.0 Runoff=0.21 cfs 0.070 af

Subcatchment B1AB: Parking Pervious Area Runoff Area=5,160 sf 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=0.09 cfs 0.032 af

Subcatchment B1AT: Parking Impervious Runoff Area=33,428 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.96 cfs 0.324 af

Subcatchment BPR1: Business Roofs Runoff Area=3,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.09 cfs 0.029 af

Subcatchment CWN: Street Runoff Area=22,251 sf 82.63% Impervious Runoff Depth=4.75"
Tc=11.0 min CN=81.0/98.0 Runoff=0.56 cfs 0.202 af

Subcatchment CWS: Street, sidewalk, Runoff Area=30,128 sf 73.27% Impervious Runoff Depth=4.58"
Tc=11.0 min CN=81.0/98.0 Runoff=0.73 cfs 0.264 af

Subcatchment LPW: Lower parking Runoff Area=21,245 sf 93.58% Impervious Runoff Depth=4.96"
Tc=5.0 min CN=83.0/98.0 Runoff=0.60 cfs 0.202 af

Subcatchment OVSR: Offsite Residential - Runoff Area=244,726 sf 0.00% Impervious Runoff Depth=3.45"
Tc=25.0 min CN=83.0/0.0 Runoff=3.69 cfs 1.614 af

Subcatchment OVSRW: Offsite (ROW Runoff Area=62,071 sf 79.42% Impervious Runoff Depth=4.67"
Tc=10.0 min CN=80.0/98.0 Runoff=1.56 cfs 0.555 af

Subcatchment OVWL: Offsite pervious - Runoff Area=97,317 sf 100.00% Impervious Runoff Depth=5.06"
Tc=15.0 min CN=0.0/98.0 Runoff=2.49 cfs 0.943 af

Subcatchment OVWPL: Offsite - Runoff Area=115,995 sf 92.63% Impervious Runoff Depth=4.92"
Tc=5.0 min CN=80.0/98.0 Runoff=3.24 cfs 1.092 af

Subcatchment OVWR: Offsite Impervious Runoff Area=67,651 sf 100.00% Impervious Runoff Depth=5.06"
Tc=15.0 min CN=0.0/98.0 Runoff=1.73 cfs 0.655 af

Subcatchment P: Payne Road - future Runoff Area=14,218 sf 69.05% Impervious Runoff Depth=4.66"
Tc=0.0 min CN=86.0/98.0 Runoff=0.39 cfs 0.127 af

Subcatchment RP1: Lot 1 and 5 (roofs) Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.37 cfs 0.126 af

Pond A-1: MH A2 TO MH A1A & MH A1B Peak Elev=201.95' Inflow=16.93 cfs 6.377 af
Primary=8.46 cfs 3.188 af Secondary=8.46 cfs 3.188 af Outflow=16.93 cfs 6.377 af

Pond A-2: MH A3 TO MH A2 Peak Elev=202.33' Inflow=1.04 cfs 0.349 af
10.0" Round Culvert n=0.013 L=143.6' S=0.0079 '/' Outflow=1.04 cfs 0.349 af

Pond A-3: PF-15 Pittock Pl. Peak Elev=202.64' Inflow=1.04 cfs 0.349 af
10.0" Round Culvert n=0.013 L=112.6' S=0.0050 '/' Outflow=1.04 cfs 0.349 af

Pond A1A: Stilling Well 1 Peak Elev=193.36' Storage=711 cf Inflow=9.05 cfs 3.390 af
24.0" Round Culvert n=0.013 L=2.0' S=0.0000 '/' Outflow=9.03 cfs 3.382 af

Pond B-1: MH B1 - CMD and Village (MH B1 TO MH A2) Peak Elev=218.19' Inflow=14.22 cfs 5.451 af
18.0" Round Culvert n=0.013 L=188.8' S=0.0188 '/' Outflow=14.22 cfs 5.451 af

Pond B-2: MH B2 to MH B1 Peak Elev=218.35' Inflow=1.30 cfs 0.466 af
12.0" Round Culvert n=0.013 L=67.0' S=0.0096 '/' Outflow=1.30 cfs 0.466 af

Pond B-4: MH B4 to MH B1 Peak Elev=218.57' Inflow=5.23 cfs 2.168 af
18.0" Round Culvert n=0.013 L=61.5' S=0.0133 '/' Outflow=5.23 cfs 2.168 af

Pond P-1: MH B3 to MH B1 Peak Elev=222.69' Inflow=0.39 cfs 0.127 af
12.0" Round Culvert n=0.013 L=222.0' S=0.0339 '/' Outflow=0.39 cfs 0.127 af

Pond P-2: MH P1 TO MH B3 Peak Elev=229.33' Inflow=0.39 cfs 0.127 af
12.0" Round Culvert n=0.013 L=116.7' S=0.0552 '/' Outflow=0.39 cfs 0.127 af

Pond PF-P: Perk Filter Payne Peak Elev=229.47' Inflow=0.39 cfs 0.127 af
10.0" Round Culvert n=0.013 L=9.0' S=0.0056 '/' Outflow=0.39 cfs 0.127 af

Pond PF14: Perk Filter 14 to MH A2 Peak Elev=213.63' Inflow=1.05 cfs 0.356 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0080 '/' Outflow=1.05 cfs 0.356 af

Pond PF15: PF-15 Pittock Pl. Peak Elev=202.69' Inflow=0.67 cfs 0.223 af
10.0" Round Culvert n=0.013 L=1.0' S=0.0500 '/' Outflow=0.67 cfs 0.223 af

Pond PF16: Perk Filter #16 Peak Elev=196.19' Inflow=0.60 cfs 0.202 af
8.0" Round Culvert n=0.013 L=9.5' S=0.7137 '/' Outflow=0.60 cfs 0.202 af

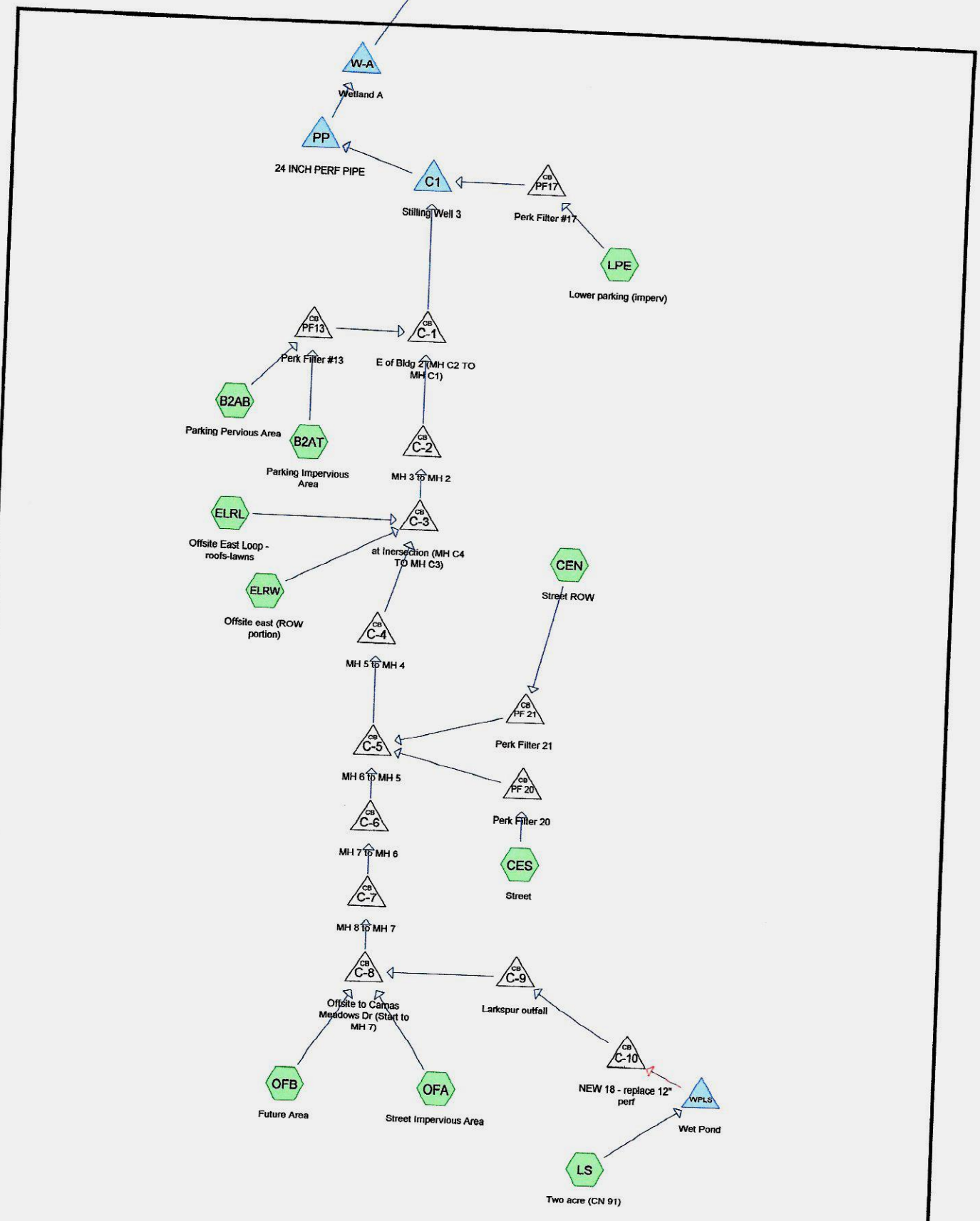
Pond PF18: Perk Filter 18 Peak Elev=218.42' Inflow=0.73 cfs 0.264 af
10.0" Round Culvert n=0.013 L=28.0' S=0.0339 '/' Outflow=0.73 cfs 0.264 af

Pond PF19: Perk Filter 19 Peak Elev=218.39' Inflow=0.56 cfs 0.202 af
10.0" Round Culvert n=0.013 L=28.0' S=0.0339 '/' Outflow=0.56 cfs 0.202 af

Pond PP: 24 INCH PERF PIPE Peak Elev=192.99' Storage=0.010 af Inflow=42.00 cfs 16.805 af
Outflow=41.97 cfs 16.805 af

Pond SW2: A1B Peak Elev=193.30' Storage=235 cf Inflow=8.46 cfs 3.188 af
24.0" Round Culvert n=0.013 L=2.0' S=0.0000 '/' Outflow=8.46 cfs 3.184 af

Pond W-A: Wetland A Peak Elev=188.18' Storage=1.500 af Inflow=72.99 cfs 30.244 af
Outflow=65.90 cfs 30.244 af


W-A
Wetland A
PP
24 INCH PERF PIPE
C1
Stilling Well 3
CB PF17
Perk Filter #17
LPE
Lower parking (imperv)
CB PF13
Perk Filter #13
CB C-1
E of Bldg 2 (MH C2 TO MH C1)
B2AB
Parking Pervious Area
B2AT
Parking Impervious Area
CB C-2
MH 3 to MH 2
ELRL
Offsite East Loop - roofs-lawns
CB C-3
at Inersection (MH C4 TO MH C3)
ELRW
Offsite east (ROW portion)
CB C-4
MH 5 to MH 4
CEN
Street ROW
CB PF 21
Perk Filter 21
CB C-5
MH 6 to MH 5
CB PF 20
Perk Filter 20
CB C-6
MH 7 to MH 6
CES
Street
CB C-7
MH 8 to MH 7
CB C-8
CB C-9
Offsite to Camas Meadows Dr (Start to MH 7)
Larkspur outfall
CB C-10
NEW 18 - replace 12" perf
WPLS
Wet Pond
OFB
Future Area
OFA
Street Impervious Area
LS
Two acre (CN 91)
Subcat
Reach
Pond
Link
LINE C
Routing Diagram for Parklands Final 8-26-2016-100-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Parklands Final 8-26-2016-100-yr-add Offsite-HGL

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	C-1	200.80	189.00	158.5	0.0744	0.013	18.0	0.0	0.0
2	C-10	238.75	237.68	163.4	0.0065	0.013	18.0	0.0	0.0
3	C-2	219.88	201.00	134.0	0.1409	0.013	18.0	0.0	0.0
4	C-3	220.21	220.08	55.6	0.0023	0.013	30.0	0.0	0.0
5	C-4	220.90	220.41	96.4	0.0051	0.013	30.0	0.0	0.0
6	C-5	221.74	221.10	118.1	0.0054	0.013	30.0	0.0	0.0
7	C-6	224.52	221.94	149.8	0.0172	0.013	30.0	0.0	0.0
8	C-7	228.59	224.72	166.3	0.0233	0.013	24.0	0.0	0.0
9	C-8	237.25	228.79	200.0	0.0423	0.013	24.0	0.0	0.0
10	C-9	237.68	237.25	121.7	0.0035	0.013	18.0	0.0	0.0
11	C1	192.00	192.00	2.0	0.0000	0.013	24.0	0.0	0.0
12	PF 20	225.19	224.01	21.8	0.0541	0.013	10.0	0.0	0.0
13	PF 21	226.02	223.99	21.8	0.0931	0.013	10.0	0.0	0.0
14	PF13	211.87	206.00	63.5	0.0924	0.013	8.0	0.0	0.0
15	PF17	199.05	190.22	16.4	0.5384	0.013	8.0	0.0	0.0
16	WPLS	239.08	238.92	112.6	0.0014	0.013	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment B2AB: Parking Pervious Area Runoff Area=4,369 sf 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=0.08 cfs 0.027 af

Subcatchment B2AT: Parking Impervious Runoff Area=21,016 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.60 cfs 0.204 af

Subcatchment CEN: Street ROW Runoff Area=27,594 sf 81.52% Impervious Runoff Depth=4.71"
Tc=11.0 min CN=80.0/98.0 Runoff=0.69 cfs 0.249 af

Subcatchment CES: Street Runoff Area=26,070 sf 72.87% Impervious Runoff Depth=4.55"
Tc=11.0 min CN=80.0/98.0 Runoff=0.63 cfs 0.227 af

Subcatchment ELRL: Offsite East Loop - Runoff Area=118,219 sf 0.00% Impervious Runoff Depth=3.45"
Tc=25.0 min CN=83.0/0.0 Runoff=1.78 cfs 0.780 af

Subcatchment ELRW: Offsite east (ROW Runoff Area=57,368 sf 73.29% Impervious Runoff Depth=4.55"
Tc=10.0 min CN=80.0/98.0 Runoff=1.41 cfs 0.500 af

Subcatchment LPE: Lower parking Runoff Area=20,949 sf 96.50% Impervious Runoff Depth=5.01"
Tc=5.0 min CN=83.0/98.0 Runoff=0.60 cfs 0.201 af

Subcatchment LS: Two acre (CN 91) Runoff Area=6.500 ac 50.15% Impervious Runoff Depth=4.41"
Tc=15.0 min CN=86.0/98.0 Runoff=6.38 cfs 2.387 af

Subcatchment OFA: Street Impervious Runoff Area=37,500 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=1.08 cfs 0.363 af

Subcatchment OFB: Future Area Runoff Area=602,064 sf 0.00% Impervious Runoff Depth=4.53"
Tc=10.0 min CN=93.3/0.0 Runoff=15.30 cfs 5.213 af

Pond C-1: E of Bldg 2 (MH C2 TO MH C1) Peak Elev=209.45' Inflow=23.92 cfs 10.043 af
18.0" Round Culvert n=0.013 L=158.5' S=0.0744 '/' Outflow=23.92 cfs 10.043 af

Pond C-10: NEW 18 - replace 12" perf Peak Elev=240.13' Inflow=3.26 cfs 2.481 af
18.0" Round Culvert n=0.013 L=163.4' S=0.0065 '/' Outflow=3.26 cfs 2.481 af

Pond C-2: MH 3 to MH 2 Peak Elev=228.10' Inflow=23.25 cfs 9.812 af
18.0" Round Culvert n=0.013 L=134.0' S=0.1409 '/' Outflow=23.25 cfs 9.812 af

Pond C-3: at Inersection (MH C4 TO MH C3) Peak Elev=229.06' Inflow=23.25 cfs 9.812 af
30.0" Round Culvert n=0.013 L=55.6' S=0.0023 '/' Outflow=23.25 cfs 9.812 af

Pond C-4: MH 5 to MH 4 Peak Elev=229.74' Inflow=20.10 cfs 8.533 af
30.0" Round Culvert n=0.013 L=96.4' S=0.0051 '/' Outflow=20.10 cfs 8.533 af

Pond C-5: MH 6 to MH 5 Peak Elev=230.38' Inflow=20.10 cfs 8.533 af
30.0" Round Culvert n=0.013 L=118.1' S=0.0054 '/' Outflow=20.10 cfs 8.533 af

Pond C-6: MH 7 to MH 6 Peak Elev=230.94' Inflow=18.78 cfs 8.057 af
30.0" Round Culvert n=0.013 L=149.8' S=0.0172 '/' Outflow=18.78 cfs 8.057 af

Pond C-7: MH 8 to MH 7 Peak Elev=232.64' Inflow=18.78 cfs 8.057 af
24.0" Round Culvert n=0.013 L=166.3' S=0.0233 '/' Outflow=18.78 cfs 8.057 af

Pond C-8: Offsite to Camas Meadows Dr (Start to MH 7) Peak Elev=239.79' Inflow=18.78 cfs 8.057 af
24.0" Round Culvert n=0.013 L=200.0' S=0.0423 '/' Outflow=18.78 cfs 8.057 af

Pond C-9: Larkspur outfall Peak Elev=239.90' Inflow=3.26 cfs 2.481 af
18.0" Round Culvert n=0.013 L=121.7' S=0.0035 '/' Outflow=3.26 cfs 2.481 af

Pond C1: Stilling Well 3 Peak Elev=194.07' Storage=0.006 af Inflow=24.51 cfs 10.243 af
24.0" Round Culvert x 2.00 n=0.013 L=2.0' S=0.0000 '/' Outflow=24.50 cfs 10.239 af

Pond PF 20: Perk Filter 20 Peak Elev=230.43' Inflow=0.63 cfs 0.227 af
10.0" Round Culvert n=0.013 L=21.8' S=0.0541 '/' Outflow=0.63 cfs 0.227 af

Pond PF 21: Perk Filter 21 Peak Elev=230.44' Inflow=0.69 cfs 0.249 af
10.0" Round Culvert n=0.013 L=21.8' S=0.0931 '/' Outflow=0.69 cfs 0.249 af

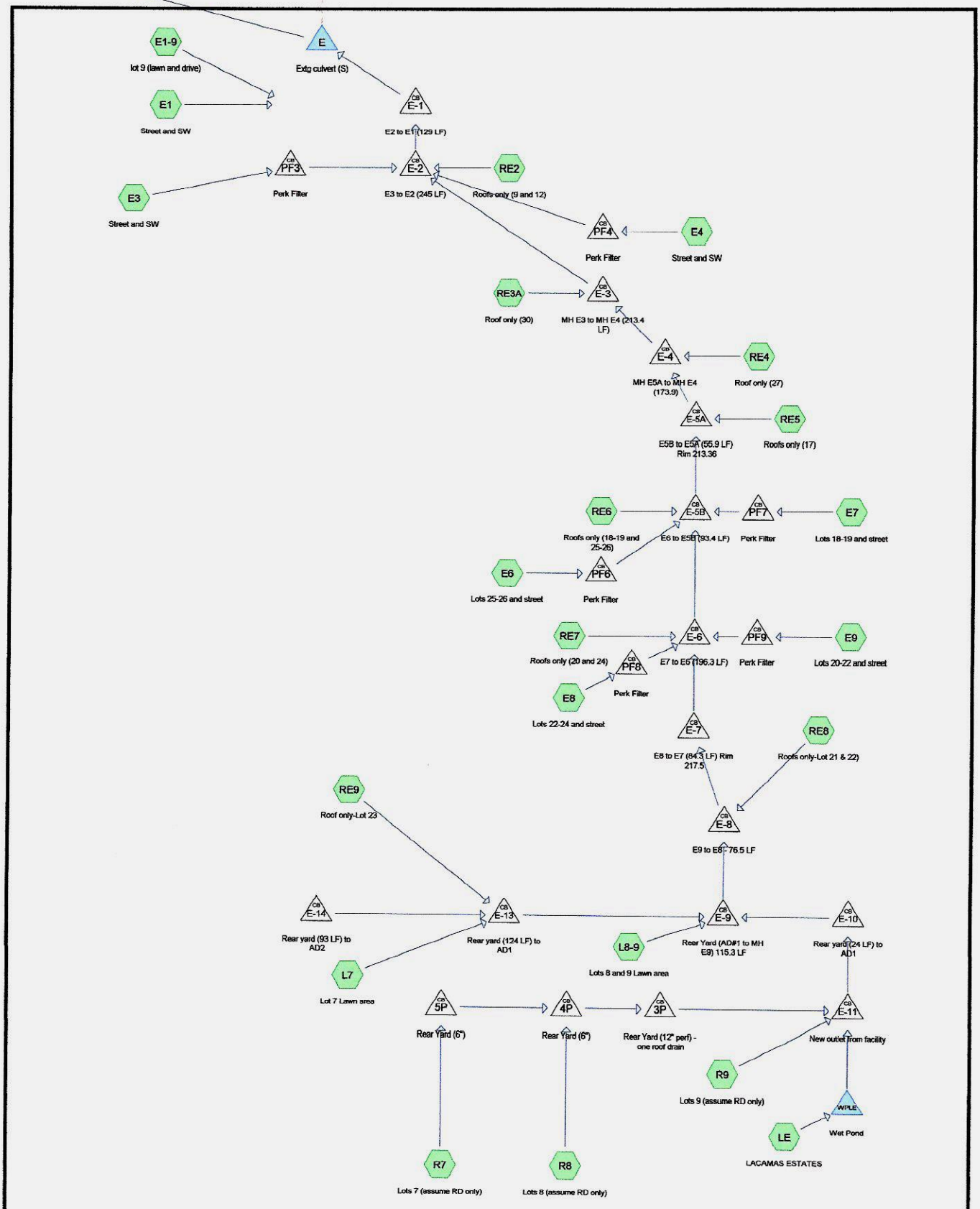
Pond PF13: Perk Filter #13 Peak Elev=212.37' Inflow=0.68 cfs 0.231 af
8.0" Round Culvert n=0.013 L=63.5' S=0.0924 '/' Outflow=0.68 cfs 0.231 af

Pond PF17: Perk Filter #17 Peak Elev=199.51' Inflow=0.60 cfs 0.201 af
8.0" Round Culvert n=0.013 L=16.4' S=0.5384 '/' Outflow=0.60 cfs 0.201 af

Pond PP: 24 INCH PERF PIPE Peak Elev=192.99' Storage=0.010 af Inflow=42.00 cfs 16.805 af
Outflow=41.97 cfs 16.805 af

Pond W-A: Wetland A Peak Elev=188.18' Storage=1.500 af Inflow=72.99 cfs 30.244 af
Outflow=65.90 cfs 30.244 af

Pond WPLS: Wet Pond Peak Elev=241.27' Storage=35,900 cf Inflow=6.38 cfs 2.387 af
Primary=3.26 cfs 2.481 af Secondary=0.00 cfs 0.000 af Outflow=3.26 cfs 2.481 af


E1-9
lot 9 (lawn and drive)
E
Extg culvert (S)
E1
Street and SW
E-1
E2 to E1 (129 LF)
PF3
Perk Filter
E-2
E3 to E2 (245 LF)
RE2
Roofs only (9 and 12)
E3
Street and SW
PF4
Perk Filter
E4
Street and SW
RE3A
Roof only (30)
E-3
MH E3 to MH E4 (213.4 LF)
E-4
MH E5A to MH E4 (173.9)
RE4
Roof only (27)
E-5A
E5B to E5A (55.9 LF) Rim 213.36
RE5
Roofs only (17)
RE6
Roofs only (18-19 and 25-26)
E-5B
E6 to E5B (93.4 LF)
PF7
Perk Filter
E7
Lots 18-19 and street
E6
Lots 25-26 and street
PF6
Perk Filter
RE7
Roofs only (20 and 24)
E-6
E7 to E6 (196.3 LF)
PF9
Perk Filter
E9
Lots 20-22 and street
PF8
Perk Filter
E8
Lots 22-24 and street
E-7
E8 to E7 (84.3 LF) Rim 217.5
RE8
Roofs only-Lot 21 & 22)
RE9
Roof only-Lot 23
E-8
E9 to E8 - 76.5 LF
E-14
Rear yard (93 LF) to AD2
E-13
Rear yard (124 LF) to AD1
E-9
Rear Yard (AD#1 to MH E9) 115.3 LF
E-10
Rear yard (24 LF) to AD1
L8-9
Lots 8 and 9 Lawn area
L7
Lot 7 Lawn area
5P
Rear Yard (6")
4P
Rear Yard (6")
3P
Rear Yard (12" perf) - one roof drain
E-11
New outlet from facility
R9
Lots 9 (assume RD only)
WPLE
Wet Pond
LE
LACAMAS ESTATES
R7
Lots 7 (assume RD only)
R8
Lots 8 (assume RD only)
Subcat
Reach
Pond
Link
LINE E
Routing Diagram for Parklands Final 8-26-2016-100-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	218.62	218.61	70.0	0.0001	0.013	12.0	0.0	0.0
2	4P	218.62	218.61	15.0	0.0007	0.013	6.0	0.0	0.0
3	5P	218.62	218.61	15.0	0.0007	0.013	6.0	0.0	0.0
4	E	187.47	187.47	30.0	0.0000	0.013	24.0	0.0	0.0
5	E	187.98	186.06	43.0	0.0447	0.013	24.0	0.0	0.0
6	E-1	190.00	187.98	129.1	0.0156	0.013	18.0	0.0	0.0
7	E-10	216.00	215.85	25.0	0.0060	0.013	15.0	0.0	0.0
8	E-11	218.62	217.00	14.0	0.1157	0.013	12.0	0.0	0.0
9	E-13	216.00	215.50	124.0	0.0040	0.013	12.0	0.0	0.0
10	E-14	226.00	216.00	94.8	0.1055	0.013	12.0	0.0	0.0
11	E-2	198.09	190.20	244.9	0.0322	0.013	18.0	0.0	0.0
12	E-3	205.00	198.29	213.4	0.0314	0.013	18.0	0.0	0.0
13	E-4	207.90	205.20	173.9	0.0155	0.013	18.0	0.0	0.0
14	E-5A	208.80	208.10	55.9	0.0125	0.013	18.0	0.0	0.0
15	E-5B	210.15	209.00	93.4	0.0123	0.013	18.0	0.0	0.0
16	E-6	212.15	210.35	196.3	0.0092	0.013	15.0	0.0	0.0
17	E-7	213.00	212.35	84.3	0.0077	0.013	15.0	0.0	0.0
18	E-8	214.00	213.00	76.5	0.0131	0.013	15.0	0.0	0.0
19	E-9	215.50	214.00	115.3	0.0130	0.013	15.0	0.0	0.0
20	PF3	199.47	199.40	15.0	0.0047	0.013	8.0	0.0	0.0
21	PF4	198.38	198.33	10.0	0.0050	0.013	8.0	0.0	0.0
22	PF6	210.21	210.15	12.0	0.0050	0.013	8.0	0.0	0.0
23	PF7	210.21	210.15	10.0	0.0060	0.013	8.0	0.0	0.0
24	PF8	212.21	212.15	12.0	0.0050	0.013	8.0	0.0	0.0
25	PF9	212.21	212.15	10.0	0.0060	0.013	8.0	0.0	0.0
26	WPLE	222.68	222.53	6.5	0.0231	0.013	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Street and SW Runoff Area=6,391 sf 91.72% Impervious Runoff Depth=4.90"
Tc=5.0 min CN=80.0/98.0 Runoff=0.18 cfs 0.060 af

Subcatchment E1-9: lot 9 (lawn and drive) Runoff Area=8,576 sf 11.66% Impervious Runoff Depth=3.64"
Tc=10.0 min CN=83.0/98.0 Runoff=0.17 cfs 0.060 af

Subcatchment E3: Street and SW Runoff Area=14,647 sf 87.33% Impervious Runoff Depth=4.82"
Tc=5.0 min CN=80.0/98.0 Runoff=0.40 cfs 0.135 af

Subcatchment E4: Street and SW Runoff Area=23,546 sf 58.09% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=80.0/98.0 Runoff=0.57 cfs 0.192 af

Subcatchment E6: Lots 25-26 and street Runoff Area=22,191 sf 28.21% Impervious Runoff Depth=4.10"
Tc=15.0 min CN=85.8/98.0 Runoff=0.47 cfs 0.174 af

Subcatchment E7: Lots 18-19 and street Runoff Area=22,129 sf 28.29% Impervious Runoff Depth=4.11"
Tc=15.0 min CN=85.8/98.0 Runoff=0.47 cfs 0.174 af

Subcatchment E8: Lots 22-24 and street Runoff Area=24,137 sf 22.82% Impervious Runoff Depth=4.04"
Tc=15.0 min CN=85.9/98.0 Runoff=0.50 cfs 0.187 af

Subcatchment E9: Lots 20-22 and street Runoff Area=24,137 sf 22.82% Impervious Runoff Depth=4.04"
Tc=15.0 min CN=85.9/98.0 Runoff=0.50 cfs 0.187 af

Subcatchment L7: Lot 7 Lawn area Runoff Area=0.137 ac 0.00% Impervious Runoff Depth=3.75"
Tc=15.0 min CN=86.0/0.0 Runoff=0.12 cfs 0.043 af

Subcatchment L8-9: Lots 8 and 9 Lawn area Runoff Area=0.273 ac 0.00% Impervious Runoff Depth=3.75"
Tc=15.0 min CN=86.0/0.0 Runoff=0.23 cfs 0.085 af

Subcatchment LE: LACAMAS ESTATES Runoff Area=6.590 ac 67.37% Impervious Runoff Depth=4.63"
Tc=15.0 min CN=86.0/98.0 Runoff=6.77 cfs 2.545 af

Subcatchment R7: Lots 7 (assume RD Runoff Area=0.103 ac 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.13 cfs 0.043 af

Subcatchment R8: Lots 8 (assume RD Runoff Area=0.103 ac 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.13 cfs 0.043 af

Subcatchment R9: Lots 9 (assume RD Runoff Area=0.103 ac 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.13 cfs 0.043 af

Subcatchment RE2: Roofs only (9 and 12) Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=10.0 min CN=0.0/98.0 Runoff=0.35 cfs 0.126 af

Subcatchment RE3A: Roof only (30) Runoff Area=6,500 sf 100.00% Impervious Runoff Depth=5.06"
Tc=10.0 min CN=0.0/98.0 Runoff=0.18 cfs 0.063 af

Subcatchment RE4: Roof only (27) Runoff Area=6,500 sf 100.00% Impervious Runoff Depth=5.06"
Tc=10.0 min CN=0.0/98.0 Runoff=0.18 cfs 0.063 af

Subcatchment RE5: Roofs only (17) Runoff Area=6,500 sf 100.00% Impervious Runoff Depth=5.06"
Tc=10.0 min CN=0.0/98.0 Runoff=0.18 cfs 0.063 af

Subcatchment RE6: Roofs only (18-19 Runoff Area=26,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.75 cfs 0.252 af

Subcatchment RE7: Roofs only (20 and Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.37 cfs 0.126 af

Subcatchment RE8: Roofs only-Lot 21 & Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.37 cfs 0.126 af

Subcatchment RE9: Roof only-Lot 23 Runoff Area=6,500 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.19 cfs 0.063 af

Pond 3P: Rear Yard (12" perf) - one roof drain Peak Elev=220.26' Inflow=0.26 cfs 0.087 af
12.0" Round Culvert n=0.013 L=70.0' S=0.0001 '/' Outflow=0.26 cfs 0.087 af

Pond 4P: Rear Yard (6") Peak Elev=220.28' Inflow=0.26 cfs 0.087 af
6.0" Round Culvert n=0.013 L=15.0' S=0.0007 '/' Outflow=0.26 cfs 0.087 af

Pond 5P: Rear Yard (6") Peak Elev=220.28' Inflow=0.13 cfs 0.043 af
6.0" Round Culvert n=0.013 L=15.0' S=0.0007 '/' Outflow=0.13 cfs 0.043 af

Pond E: Extg culvert (S) Peak Elev=189.33' Storage=41 cf Inflow=16.68 cfs 7.325 af
Primary=9.56 cfs 5.204 af Secondary=7.13 cfs 2.121 af Outflow=16.67 cfs 7.325 af

Pond E-1: E2 to E1 (129 LF) Peak Elev=194.60' Inflow=16.33 cfs 7.160 af
18.0" Round Culvert n=0.013 L=129.1' S=0.0156 '/' Outflow=16.33 cfs 7.160 af

Pond E-10: Rear yard (24 LF) to AD1 Peak Elev=217.29' Inflow=4.04 cfs 2.673 af
15.0" Round Culvert n=0.013 L=25.0' S=0.0060 '/' Outflow=4.04 cfs 2.673 af

Pond E-11: New outlet from facility Peak Elev=220.26' Inflow=4.04 cfs 2.673 af
12.0" Round Culvert n=0.013 L=14.0' S=0.1157 '/' Outflow=4.04 cfs 2.673 af

Pond E-13: Rear yard (124 LF) to AD1 Peak Elev=216.68' Inflow=0.30 cfs 0.106 af
12.0" Round Culvert n=0.013 L=124.0' S=0.0040 '/' Outflow=0.30 cfs 0.106 af

Pond E-14: Rear yard (93 LF) to AD2 Peak Elev=0.00'
12.0" Round Culvert n=0.013 L=94.8' S=0.1055 '/' Primary=0.00 cfs 0.000 af

Pond E-2: E3 to E2 (245 LF) Peak Elev=202.52' Inflow=16.33 cfs 7.160 af
18.0" Round Culvert n=0.013 L=244.9' S=0.0322 '/' Outflow=16.33 cfs 7.160 af

Pond E-3: MH E3 to MH E4 (213.4 LF) Peak Elev=207.60' Inflow=11.57 cfs 5.471 af
18.0" Round Culvert n=0.013 L=213.4' S=0.0314 '/' Outflow=11.57 cfs 5.471 af

Pond E-4: MH E5A to MH E4 (173.9) Peak Elev=209.53' Inflow=7.97 cfs 4.215 af
18.0" Round Culvert n=0.013 L=173.9' S=0.0155 '/' Outflow=7.97 cfs 4.215 af

Pond E-5A: E5B to E5A (55.9 LF) Rim 213.36 Peak Elev=210.43' Inflow=7.79 cfs 4.152 af
18.0" Round Culvert n=0.013 L=55.9' S=0.0125 '/' Outflow=7.79 cfs 4.152 af

Pond E-5B: E6 to E5B (93.4 LF) Peak Elev=211.70' Inflow=7.61 cfs 4.089 af
18.0" Round Culvert n=0.013 L=93.4' S=0.0123 '/' Outflow=7.61 cfs 4.089 af

Pond E-6: E7 to E6 (196.3 LF) Peak Elev=213.79' Inflow=5.97 cfs 3.489 af
15.0" Round Culvert n=0.013 L=196.3' S=0.0092 '/' Outflow=5.97 cfs 3.489 af

Pond E-7: E8 to E7 (84.3 LF) Rim 217.5 Peak Elev=214.53' Inflow=4.62 cfs 2.990 af
15.0" Round Culvert n=0.013 L=84.3' S=0.0077 '/' Outflow=4.62 cfs 2.990 af

Pond E-8: E9 to E8 - 76.5 LF Peak Elev=215.35' Inflow=4.62 cfs 2.990 af
15.0" Round Culvert n=0.013 L=76.5' S=0.0131 '/' Outflow=4.62 cfs 2.990 af

Pond E-9: Rear Yard (AD#1 to MH E9) 115.3 LF Peak Elev=216.66' Inflow=4.37 cfs 2.864 af
15.0" Round Culvert n=0.013 L=115.3' S=0.0130 '/' Outflow=4.37 cfs 2.864 af

Pond PF3: Perk Filter Peak Elev=202.58' Inflow=0.40 cfs 0.135 af
8.0" Round Culvert n=0.013 L=15.0' S=0.0047 '/' Outflow=0.40 cfs 0.135 af

Pond PF4: Perk Filter Peak Elev=202.63' Inflow=0.57 cfs 0.192 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0050 '/' Outflow=0.57 cfs 0.192 af

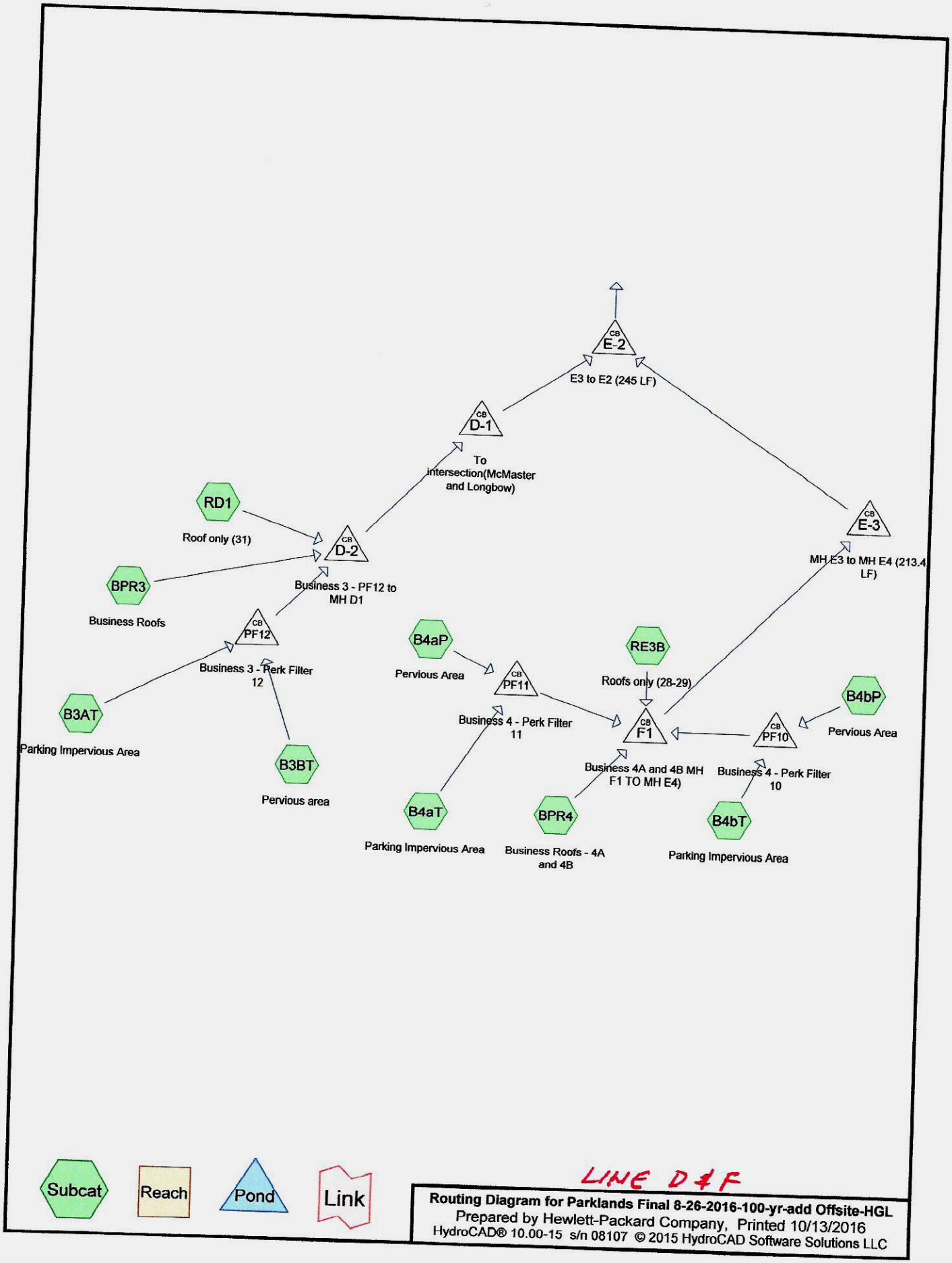
Pond PF6: Perk Filter Peak Elev=211.78' Inflow=0.47 cfs 0.174 af
8.0" Round Culvert n=0.013 L=12.0' S=0.0050 '/' Outflow=0.47 cfs 0.174 af

Pond PF7: Perk Filter Peak Elev=211.78' Inflow=0.47 cfs 0.174 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0060 '/' Outflow=0.47 cfs 0.174 af

Pond PF8: Perk Filter Peak Elev=213.88' Inflow=0.50 cfs 0.187 af
8.0" Round Culvert n=0.013 L=12.0' S=0.0050 '/' Outflow=0.50 cfs 0.187 af

Pond PF9: Perk Filter Peak Elev=213.88' Inflow=0.50 cfs 0.187 af
8.0" Round Culvert n=0.013 L=10.0' S=0.0060 '/' Outflow=0.50 cfs 0.187 af

Pond WPLE: Wet Pond Peak Elev=224.88' Storage=41,208 cf Inflow=6.77 cfs 2.545 af
12.0" Round Culvert n=0.013 L=6.5' S=0.0231 '/' Outflow=3.89 cfs 2.543 af


CB E-2
E3 to E2 (245 LF)
CB D-1
To intersection(McMaster and Longbow)
RD1
Roof only (31)
CB D-2
CB E-3
MH E3 to MH E4 (213.4 LF)
BPR3
Business Roofs
Business 3 - PF12 to MH D1
CB PF12
Business 3 - Perk Filter 12
B4aP
Pervious Area
CB PF11
RE3B
Roofs only (28-29)
B4bP
Pervious Area
B3AT
Parking Impervious Area
B3BT
Pervious area
Business 4 - Perk Filter 11
CB F1
CB PF10
Business 4A and 4B MH F1 TO MH E4)
Business 4 - Perk Filter 10
B4aT
Parking Impervious Area
BPR4
Business Roofs - 4A and 4B
B4bT
Parking Impervious Area
Subcat
Reach
Pond
Link
LINE D & F
Routing Diagram for Parklands Final 8-26-2016-100-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	D-1	200.00	198.29	135.8	0.0126	0.013	12.0	0.0	0.0
2	D-2	215.79	200.64	138.0	0.1098	0.013	10.0	0.0	0.0
3	E-2	198.09	190.20	244.9	0.0322	0.013	18.0	0.0	0.0
4	E-3	205.00	198.29	213.4	0.0314	0.013	18.0	0.0	0.0
5	F1	215.45	205.29	180.7	0.0562	0.013	12.0	0.0	0.0
6	PF10	220.90	215.55	85.6	0.0625	0.013	10.0	0.0	0.0
7	PF11	220.68	215.55	125.6	0.0408	0.013	10.0	0.0	0.0
8	PF12	215.79	215.78	1.0	0.0100	0.013	10.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment B3AT: Parking Impervious Runoff Area=30,681 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.88 cfs 0.297 af

Subcatchment B3BT: Pervious area Runoff Area=9,998 sf 0.00% Impervious Runoff Depth=3.25"
Tc=5.0 min CN=81.0/0.0 Runoff=0.19 cfs 0.062 af

Subcatchment B4aP: Pervious Area Runoff Area=3,662 sf 0.00% Impervious Runoff Depth=3.25"
Tc=5.0 min CN=81.0/0.0 Runoff=0.07 cfs 0.023 af

Subcatchment B4aT: Parking Impervious Runoff Area=35,023 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=1.01 cfs 0.339 af

Subcatchment B4bP: Pervious Area Runoff Area=6,109 sf 0.00% Impervious Runoff Depth=3.25"
Tc=5.0 min CN=81.0/0.0 Runoff=0.11 cfs 0.038 af

Subcatchment B4bT: Parking Impervious Runoff Area=37,875 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=1.09 cfs 0.367 af

Subcatchment BPR3: Business Roofs Runoff Area=21,950 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.63 cfs 0.213 af

Subcatchment BPR4: Business Roofs - Runoff Area=31,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=0.0/98.0 Runoff=0.89 cfs 0.300 af

Subcatchment RD1: Roof only (31) Runoff Area=6,500 sf 100.00% Impervious Runoff Depth=5.06"
Tc=10.0 min CN=0.0/98.0 Runoff=0.18 cfs 0.063 af

Subcatchment RE3B: Roofs only (28-29) Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=10.0 min CN=0.0/98.0 Runoff=0.35 cfs 0.126 af

Pond D-1: To intersection(McMaster and Longbow) Peak Elev=203.00' Inflow=1.87 cfs 0.635 af
12.0" Round Culvert n=0.013 L=135.8' S=0.0126 '/' Outflow=1.87 cfs 0.635 af

Pond D-2: Business 3 - PF12 to MH D1 Peak Elev=216.72' Inflow=1.87 cfs 0.635 af
10.0" Round Culvert n=0.013 L=138.0' S=0.1098 '/' Outflow=1.87 cfs 0.635 af

Pond E-2: E3 to E2 (245 LF) Peak Elev=202.52' Inflow=16.33 cfs 7.160 af
18.0" Round Culvert n=0.013 L=244.9' S=0.0322 '/' Outflow=16.33 cfs 7.160 af

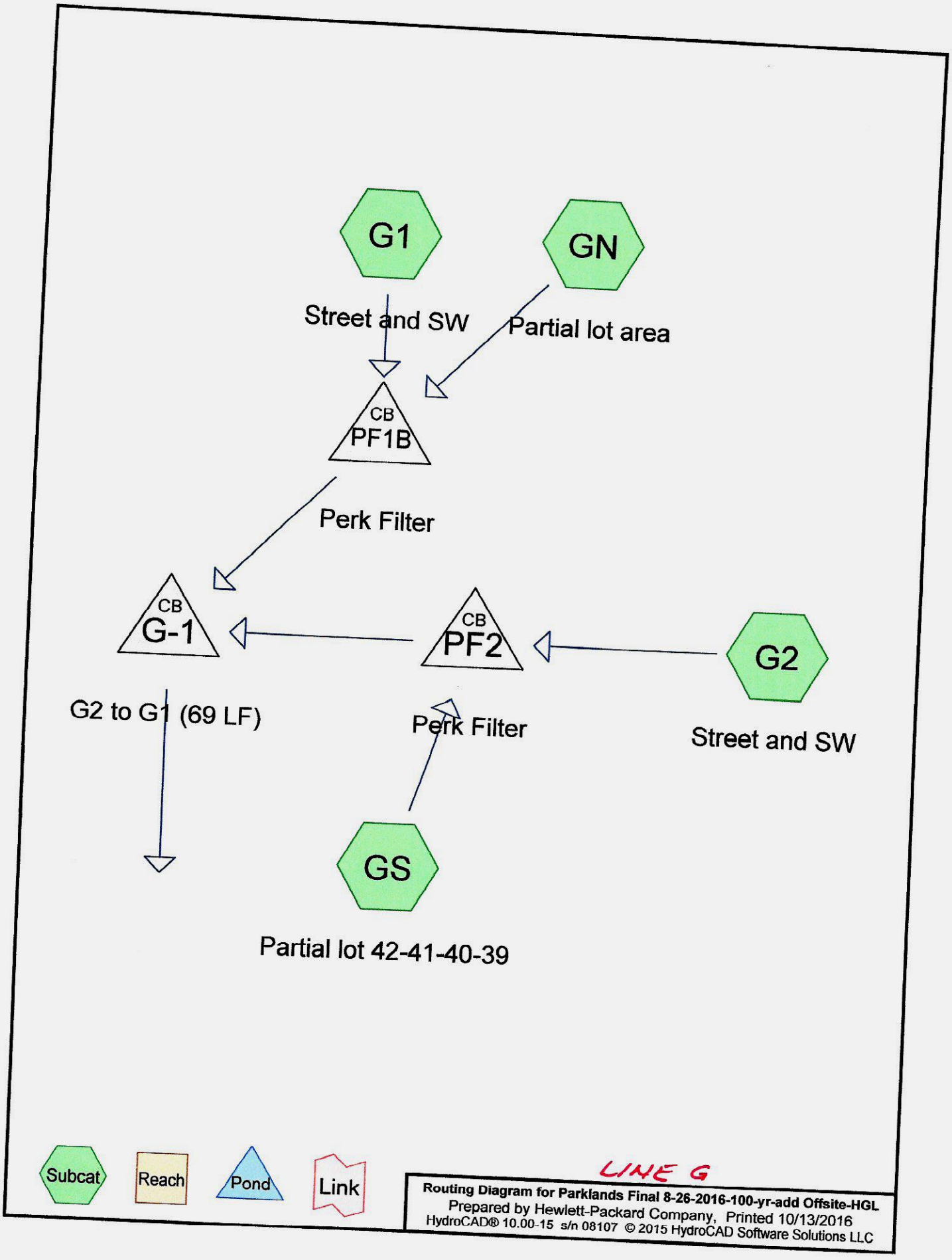
Pond E-3: MH E3 to MH E4 (213.4 LF) Peak Elev=207.60' Inflow=11.57 cfs 5.471 af
18.0" Round Culvert n=0.013 L=213.4' S=0.0314 '/' Outflow=11.57 cfs 5.471 af

Pond F1: Business 4A and 4B MH F1 TO MH E4) Peak Elev=216.82' Inflow=3.52 cfs 1.193 af
12.0" Round Culvert n=0.013 L=180.7' S=0.0562 '/' Outflow=3.52 cfs 1.193 af

Pond PF10: Business 4 - Perk Filter 10 Peak Elev=221.53' Inflow=1.20 cfs 0.405 af
10.0" Round Culvert n=0.013 L=85.6' S=0.0625 '/' Outflow=1.20 cfs 0.405 af

Pond PF11: Business 4 - Perk Filter 11 Peak Elev=221.27' Inflow=1.08 cfs 0.362 af
10.0" Round Culvert n=0.013 L=125.6' S=0.0408 '/' Outflow=1.08 cfs 0.362 af

Pond PF12: Business 3 - Perk Filter 12 Peak Elev=216.88' Inflow=1.07 cfs 0.359 af
10.0" Round Culvert n=0.013 L=1.0' S=0.0100 '/' Outflow=1.07 cfs 0.359 af


G1
GN
Street and SW
Partial lot area
CB
PF1B
Perk Filter
CB
G-1
CB
PF2
G2
G2 to G1 (69 LF)
Perk Filter
Street and SW
GS
Partial lot 42-41-40-39
Subcat
Reach
Pond
Link
LINE G
Routing Diagram for Parklands Final 8-26-2016-100-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	G-1	186.34	186.07	63.8	0.0042	0.011	12.0	0.0	0.0
2	PF1B	186.50	186.34	19.0	0.0084	0.013	6.0	0.0	0.0
3	PF2	186.41	186.34	18.0	0.0039	0.013	6.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment G1: Street and SW Runoff Area=19,098 sf 83.10% Impervious Runoff Depth=4.74"
Tc=5.0 min CN=80.0/98.0 Runoff=0.51 cfs 0.173 af

Subcatchment G2: Street and SW Runoff Area=13,561 sf 90.52% Impervious Runoff Depth=4.88"
Tc=5.0 min CN=80.0/98.0 Runoff=0.38 cfs 0.127 af

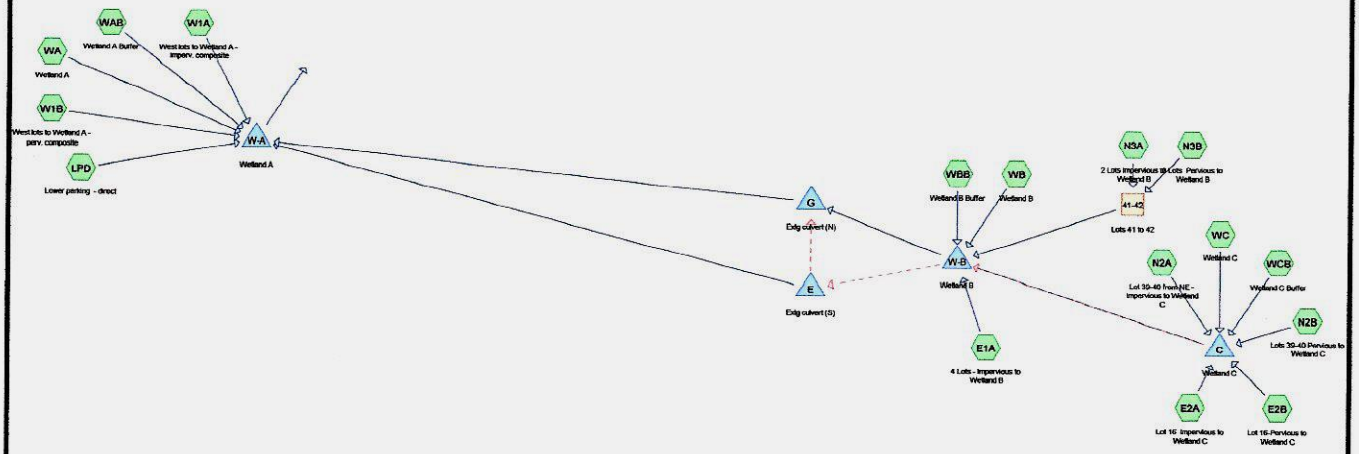
Subcatchment GN: Partial lot area Runoff Area=24,500 sf 26.53% Impervious Runoff Depth=3.88"
Tc=10.0 min CN=83.0/98.0 Runoff=0.52 cfs 0.182 af

Subcatchment GS: Partial lot 42-41-40-39 Runoff Area=18,500 sf 27.03% Impervious Runoff Depth=3.88"
Tc=10.0 min CN=83.0/98.0 Runoff=0.39 cfs 0.137 af

Pond G-1: G2 to G1 (69 LF) Peak Elev=188.91' Inflow=1.79 cfs 0.619 af
12.0" Round Culvert n=0.011 L=63.8' S=0.0042 '/' Outflow=1.79 cfs 0.619 af

Pond PF1B: Perk Filter Peak Elev=190.15' Inflow=1.02 cfs 0.355 af
6.0" Round Culvert n=0.013 L=19.0' S=0.0084 '/' Outflow=1.02 cfs 0.355 af

Pond PF2: Perk Filter Peak Elev=189.57' Inflow=0.76 cfs 0.264 af
6.0" Round Culvert n=0.013 L=18.0' S=0.0039 '/' Outflow=0.76 cfs 0.264 af



Subcat Reach Pond Link

THRU WETLANDS

Routing Diagram for Parklands Final 8-26-2016-100-yr-add Offsite-HGL
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
10.950	81.0	Brush (WA, WAB, WB, WBB, WC, WCB)
0.046	83.0	Drives across lawns (2 lots) - ammended (W1A)
0.138	83.0	Drives across lawns (6 lots) - ammended (W1A)
0.149	83.0	Impervious (1 at 6500) - unconnected (E2A)
0.149	98.0	Impervious (39) roof area (N2A)
0.597	83.0	Impervious (4 at 6500) - unconnected (E1A)
0.149	98.0	Impervious (40) roof area (N2A)
0.149	98.0	Impervious (41) (N3A)
0.149	98.0	Impervious (42) (N3A)
0.444	83.0	Pervious (2 lots) - ammended (W1B)
0.143	83.0	Pervious (39) ammended soil (N2B)
0.168	83.0	Pervious (40) ammended soil (N2B)
0.106	83.0	Pervious (41) ammended soils (N3B)
0.112	83.0	Pervious (42) ammended soils (N3B)
1.317	83.0	Pervious (7 lots) - ammended (W1B)
0.190	83.0	Pervious composite for unconnected (E2B)
0.298	98.0	Roofs (2 lots) (W1A)
0.746	98.0	Roofs (5 lots) (W1A)
0.268	81.0	ammended (LPD)
0.023	83.0	drive - composite CN (E2A)
0.092	83.0	drives (4 at 1000) - composite CN (E1A)

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	C	190.64	190.18	14.3	0.0322	0.013	12.0	0.0	0.0
2	C	190.73	190.30	14.5	0.0297	0.013	12.0	0.0	0.0
3	E	187.47	187.47	30.0	0.0000	0.013	24.0	0.0	0.0
4	E	187.98	186.06	43.0	0.0447	0.013	24.0	0.0	0.0
5	G	186.06	186.06	15.0	0.0000	0.013	24.0	0.0	0.0
6	W-B	188.20	187.98	13.0	0.0169	0.013	12.0	0.0	0.0
7	W-B	186.06	186.06	20.0	0.0000	0.013	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1A: 4 Lots - Impervious to Runoff Area=30,000 sf 0.00% Impervious Runoff Depth=3.45"
Tc=20.0 min CN=83.0/0.0 Runoff=0.49 cfs 0.198 af

Subcatchment E2A: Lot 16 Impervious to Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=3.45"
Tc=20.0 min CN=83.0/0.0 Runoff=0.12 cfs 0.049 af

Subcatchment E2B: Lot 16-Pervious to Runoff Area=8,298 sf 0.00% Impervious Runoff Depth=3.45"
Tc=20.0 min CN=83.0/0.0 Runoff=0.13 cfs 0.055 af

Subcatchment LPD: Lower parking - direct Runoff Area=11,678 sf 0.00% Impervious Runoff Depth=3.25"
Tc=15.0 min CN=81.0/0.0 Runoff=0.19 cfs 0.073 af

Subcatchment N2A: Lot 39-40 from NE - Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=20.0 min CN=0.0/98.0 Runoff=0.31 cfs 0.126 af

Subcatchment N2B: Lots 39-40 Pervious to Runoff Area=13,564 sf 0.00% Impervious Runoff Depth=3.45"
Tc=20.0 min CN=83.0/0.0 Runoff=0.22 cfs 0.089 af

Subcatchment N3A: 2 Lots Impervious to Runoff Area=13,000 sf 100.00% Impervious Runoff Depth=5.06"
Tc=20.0 min CN=0.0/98.0 Runoff=0.31 cfs 0.126 af

Subcatchment N3B: 2 Lots Pervious to Runoff Area=9,500 sf 0.00% Impervious Runoff Depth=3.45"
Tc=20.0 min CN=83.0/0.0 Runoff=0.15 cfs 0.063 af

Subcatchment W1A: West lots to Wetland Runoff Area=53,500 sf 85.05% Impervious Runoff Depth=4.82"
Tc=20.0 min CN=83.0/98.0 Runoff=1.22 cfs 0.493 af

Subcatchment W1B: West lots to Wetland A Runoff Area=76,699 sf 0.00% Impervious Runoff Depth=3.45"
Tc=20.0 min CN=83.0/0.0 Runoff=1.25 cfs 0.506 af

Subcatchment WA: Wetland A Runoff Area=5.970 ac 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=4.57 cfs 1.618 af

Subcatchment WAB: Wetland A Buffer Runoff Area=2.000 ac 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=1.53 cfs 0.542 af

Subcatchment WB: Wetland B Runoff Area=1.370 ac 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=1.05 cfs 0.371 af

Subcatchment WBB: Wetland B Buffer Runoff Area=55,339 sf 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=0.97 cfs 0.344 af

Subcatchment WC: Wetland C Runoff Area=5,218 sf 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=0.09 cfs 0.032 af

Subcatchment WCB: Wetland C Buffer Runoff Area=9,573 sf 0.00% Impervious Runoff Depth=3.25"
Tc=10.0 min CN=81.0/0.0 Runoff=0.17 cfs 0.060 af

Reach 41-42: Lots 41 to 42 Inflow=0.46 cfs 0.189 af
Outflow=0.46 cfs 0.189 af

Pond C: Wetland C Peak Elev=191.32' Storage=0 cf Inflow=1.05 cfs 0.412 af
Primary=0.58 cfs 0.230 af Secondary=0.46 cfs 0.182 af Outflow=1.05 cfs 0.412 af

Pond E: Extg culvert (S) Peak Elev=189.33' Storage=41 cf Inflow=16.68 cfs 7.325 af
Primary=9.56 cfs 5.204 af Secondary=7.13 cfs 2.121 af Outflow=16.67 cfs 7.325 af

Pond G: Extg culvert (N) Peak Elev=188.72' Storage=47 cf Inflow=11.37 cfs 4.439 af
24.0" Round Culvert n=0.013 L=15.0' S=0.0000 '/' Outflow=11.37 cfs 4.438 af

Pond W-A: Wetland A Peak Elev=188.18' Storage=1.500 af Inflow=72.99 cfs 30.244 af
Outflow=65.90 cfs 30.244 af

Pond W-B: Wetland B Peak Elev=189.26' Storage=0.143 af Inflow=4.63 cfs 1.765 af
Primary=3.13 cfs 1.698 af Secondary=1.27 cfs 0.045 af Outflow=4.40 cfs 1.744 af

APPENDIX C3 WATER QUALITY
C-3a PHOSPHORUS LOADING ANALYSIS
DETERMINE PERCENT PHOSPHORUS REMOVAL BASED ON AREAS

SUMMARY OF CONTRIBUTING AREAS - SEE APPENDIX D SUBBASIN AREAS				
Contributing Area Description	**Treatment Condition**	**Area (ac)**	**Area/Total Area (ratio)**	**Percent**
Lawn and drives to buffer	No Perk Filter	4.527	0.1592	15.92%
Roofs to storm	No Perk Filter	3.753	0.1320	13.20%
Roofs to buffer	No Perk Filter	4.277	0.1504	15.04%
Treated Area	to Perk Filter	15.881	0.5584	55.84%
	Total for Site*	28.438		100.0%

*includes Camas Meadows Dr. and portion of Payne Rd.

Assume buffers/wetlands will remove 40% Phosphorous Pollutant Load - Evalaute 3 Scenarios

Scenario #1: Determine Percent Removal For Site Runoff - portion to Perk Filters and to buffer

Perk Filter	15.881	62.4% per TAPE		15.881*.624	9.91
No Perk Filter	4.527	**Lawn and drives to buffer**	assume average 40%	4.760*.40	1.81
Area of concern	20.408	All Roofs assumed "clean"			11.72
			percent removal	11.72/20.408	57.4%
					exceeds 50%

Scenario #2: Determine Percent Removal For Site Runoff - portion to Perk Filters and to buffer

Perk Filter	15.881	62.4% per TAPE		15.881*.624	9.91
No Perk Filter	8.804	**Lawn,drives, roofs to buffer**	assume average 40%	8.804*.40	3.52
	24.685	Roofs to storm assumed "clean" at 3.753 ac.			13.43
			percent removal	13.43/24.685	54.4%
					exceeds 50%

Scenario #3: Determine Percent Removal For Site Runoff - portion to Perk Filters and to buffer

Perk Filter	15.881	62.4% per TAPE		16.543*.624	9.91
No Perk Filter	12.557	**Lawn, roofs, and roofs to storm**	assume average 40%	11.027*.40	5.02
	28.438	include all areas			14.93
			percent removal	14.93/28.438	52.5%
					exceeds 50%

APPENDIX C3 WATER QUALITY
C-3a PHOSPHORUS LOADING ANALYSIS
DETERMINE PERCENT PHOSPHORUS REMOVAL BASED ON AREAS

SUMMARY OF CONTRIBUTING AREAS - SEE APPENDIX D SUBBASIN AREAS				
Contributing Area Description	**Treatment Condition**	**Area (ac)**	**Area/Total Area (ratio)**	**Percent**
Lawn and drives to buffer	No Perk Filter	4.527	0.1592	15.92%
Roofs to storm	No Perk Filter	3.753	0.1320	13.20%
Roofs to buffer	No Perk Filter	4.277	0.1504	15.04%
Treated Area	to Perk Filter	15.881	0.5584	55.84%
	Total for Site*	28.438		100.0%

*includes Camas Meadows Dr. and portion of Payne Rd.

Determine Minimum Percent Removal For Buffer to Satisfy 50% removal					
	Find for 50% removal - Scenario #1		by trial and error	10.204/20.408	50.0%
	4.527 + 15.881 = 20.408				
No Perk Filter	**4.527**	**Lawn and drives to buffer**	**6.5%**	4.527*0.065	0.294
and	15.881 + 4.277 + 3.753 = 23.911 acres considered "clean"			62.4 % portion	9.91
	All Roofs assumed "clean"				10.204
	Find for 50% removal - Scenario #2		by trial and error	12.3425/24.685	50.0%
	4.527 + 4.277 + 15.881 = 24.685		lowest level removal		
No Perk Filter	**8.804**		**27.63%**	8.804*.2763	2.4325
and	15.881 + 3.753 = 19.634 acres considered "clean"			62.4 % portion	9.91
	Roofs to storm assumed "clean", Roofs to buffers not assumed 'clean'				12.3422
	Find for 50% removal - Scenario #3		by trial and error	14.219/28.438	50.0%
	4.527 + 4.277 + 3.753 + 15.881 = 28.438		lowest level removal		
No Perk Filter	**12.557**		**34.3%**	12.557*.343	4.309
and	only 15.881 acres considered "clean"			62.4 % portion	9.91
					14.219

Notes:

1. The roof portion that goes directly to the storm system and not to the buffer is 2.835 Acres (McMaster, Longbow, and Pittock and the roof portion from the south building (business) at 0.71 acres. This total of 3.55 acres is released at the two culverts betv Wetland A and B. This amount of runoff is assumed to be treated in the natural wetland ponding area - about 3.37 acre surface area. The most direct flow path through the onsite wetland is about 550 LF and then passes over another 600 LF in a shallow flo path through mostly reed canary grass. Reed canary grass is considered an excellent treatment medium.

2. The roof areas from the other three business portions (1.03 acres) will be released to the storm system and then released fro the dissipation system to the buffer (304 ft spread for sheet flow).

APPENDIX C WATER QUALITY
C-3b PHOSPHORUS LOADING CALCULATIONS

Reference : Pennsylvania Stormwater Best Management Practices Manaual
Chapter 8, Worksheet 12 (attached)

PREDEVELOPMENT AREA AND POLLUTANT LOADING				
Pre	28.437	0.30	2.7	**23.03**

Note: 0.3 is factor for HSG C soil (silt loam, clay loam or silty clay loam)

Developed - Untreated Portion to Buffer or to Wetlands				
Source	**Surface Area (ac)**	**TP EMC (mg/l)**	**Unit Conversion Factor**	**Pollutant Load**
Lots 2-10 - roofs	1.045	0.13	2.7	0.367 LBS
Lots 11-15 - roofs	0.597	0.13	2.7	0.210 LBS
Lot 16 - roof	0.149	0.13	2.7	0.052 LBS
Lots 32-38 - roofs	1.067	0.13	2.7	0.375 LBS
Lots 39-40 - roofs	0.298	0.13	2.7	0.105 LBS
Lots 41-42 - roofs	0.298	0.13	2.7	0.105 LBS
Business - roofs	4.575	0.13	2.7	1.606 LBS
Lots 2-10 - lawn/drive	0.989	0.40	2.7	1.068 LBS
Lots 11-15 - lawn/drive	1.795	0.40	2.7	1.939 LBS
Lot 16 - lawn/drive	0.213	0.40	2.7	0.230 LBS
Lots 32-38 - lawn/drive	0.731	0.40	2.7	0.789 LBS
Lots 39-40 - lawn/drive	0.311	0.40	2.7	0.336 LBS
Lots 41-42 - lawn/drive	0.218	0.40	2.7	0.235 LBS
north of parking lot	0.27	0.40	2.7	0.292 LBS
	12.556			**7.707 LBS**

Source	**Surface Area (ac)**	**TP EMC (mg/l)**	**Unit Conversion Factor**	**Pollutant Load**	
CMD	2.763	0.33	2.7	2.462 LBS	treated
Pittock	0.585	0.36	2.7	0.569 LBS	treated
Business -east	2.832	0.39	2.7	2.982 LBS	treated
Business -west	2.890	0.39	2.7	3.043 LBS	treated
Lawn to streeet	3.652	0.40	2.7	3.944 LBS	treated
Streets - R/W	3.159	0.36	2.7	3.071 LBS	treated
	15.881			**16.070 LBS**	
				7.707 LBS	
Total Post-Development Load				**23.778 LBS**	

Total Area 28.437

APPENDIX C WATER QUALITY
C-3b PHOSPHORUS LOADING CALCULATIONS

DETERMINE POLLUTANT LOADING WITH TREATMENT ACCOUNTED FOR		
16.07 lbs treated at 62.4% = 9.91 lbs removed	6.160 lbs remain	
6.495 lbs treated at 45%* = 2.923 lbs removed	3.572 lbs remain	
Pollutant Load	9.73 LBS	OK
compare Pre loading	23.03 LBS	

Note that even witout treatment credit at buffer, 6.16 + 6.495 = 12.655 LBS
which is a 45% reduction from Pre loading. So buffere only needs to provide 5% redu

*Assume wetland buffer will treat 45% of phosphorus pollutant load
1. Literature search varies on removal percentages.
However, natural buffers are considered effective even for wastewater conditions.
2. Buffer widths for 0% to 8% slopes are generally listed n the 70 to 100 LF range.
The buffer width for this site is 50 LF. However, during the WQ event, the distance to ponded water in the wetland is more than 50 feet. See attachment with contour 188 for reference.

APPENDIX D CONVEYANCE SYSTEM
D-4 REAR YARD SYSTEMS

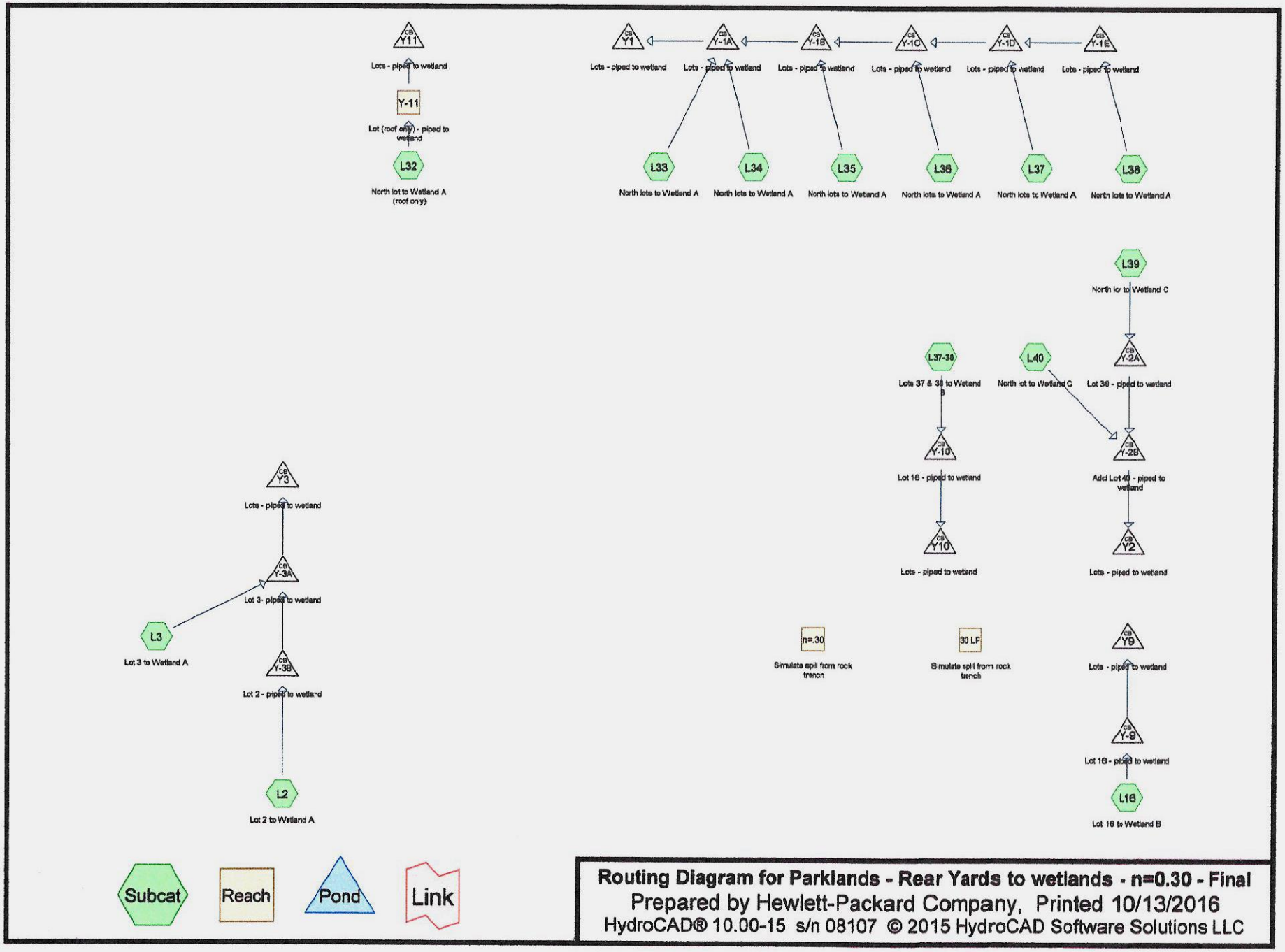
REAR YARD SYSTEMS

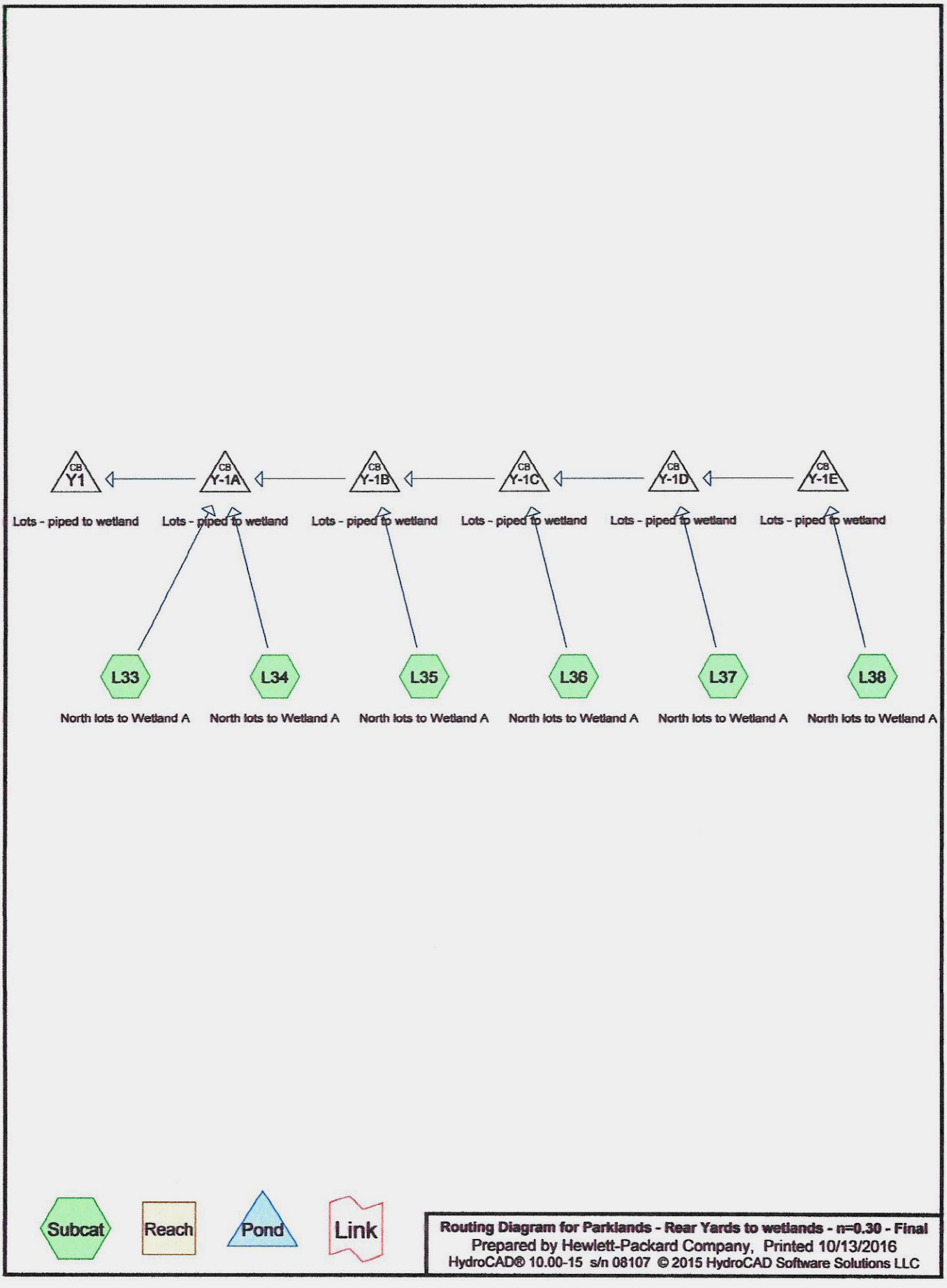
Upstream Structure ID	Downstream Structure & Perf LF ID	Pipe Length ID	Pipe Length cntr to cntr (ft)	Lot #	Pipe Size (in)	Area to System (sf)	US Rim Elev.	US Invert (ft)	DS Invert (ft)	Existing Ground Elev. (ft)	Pipe Slope cntr to cntr (ft/ft)
GR1E	GR1D	Y-1E	109	38	8	6,500/7,044	194.70	193.70	192.45	N/A	0.0115
GR1D	GR1C	Y-1D	102	37	8	6,500/4,973	193.50	192.45	191.27	N/A	0.0115
GR1C	GR1B	Y-1C	102	36	8	6,500/4,596	192.56	191.27	190.10	N/A	0.0115
GR1B	GR1A	Y-1B	95	35	8	6,500/4,603	191.75	190.10	189.01	N/A	0.0115
GR1A	Y1 (90 LF)	Perf	from GR1A	33 & 34	8	13,000/10,628	N/A	189.008	189.01	189+/-	0
GR2	Y2	Y-2A	116.0	39	6	6,500/1,000/6,235	194.00	192.00	191.55	193.00	0.0039
no inlet	Y2 (30 lf)	Y-2B	12.7	40	6	6,500	N/A	191.55	191.50	193.00	0.0039
GR3	Y3	Y-3A	63.0	3	6	6,500/1,000/8,754	200.00	198.00	191.40	---	0.1048
no inlet	Y3 (20 LF)	Y-3B	20.0	2	6	6,500	N/A	191.40	189.30	190.80	0.1050
GR4 (SOLID)	Y4 (10 LF)	Y-4	15.0	4	6	6,500	195.00	193.00	191.20	192.73	0.1200
GR5 (SOLID)	Y5 (20 LF)	Y-5	20.0	6 & 7	6	13,000	193.50	191.50	188.50	190.00	0.1500
GR6 (SOLID)	Y6 (20 LF)	Y-6	18.0	10	6	13,000	193.50	191.50	189.10	190.60	0.1333
GR7A (SOLID)	GR7B (SOLID)	Y-7A	48.0	12	6	6,500	204.00	202.00	194.13	---	0.1640
GR7B (SOLID)	Y7 (20 LF)	Y-7B	20.0	11	6	6,500	196.00	194.13	191.50	193.00	0.1315
GR8 (SOLID)	Y8 (20 LF)	Y-8	13.0	14 & 15	6	13,000	202.50	201.63	201.50	203.00	0.0100
GR9 (SOLID)	Y9 (10 LF)	Y-9	13.5	16	6	6,500	198.00	196.00	194.50	196.00	0.1111
GR10 (SOLID)	Y10 (20 LF)	Y-10	12.0	41 & 42	6	13,000	194.00	192.00	191.00	192.50	0.0833
GR11 (SOLID)	Y11 (10 LF)	Y-11	10.0	32	6	6,500	190.25	189.50	189.00	189.00	0.0500

REAR YARD RUNOFF SUMMARY DATA

Lot #	escription of how site runoff areas are manage	Lawn (sf)	Drive (sf)
2	lawn, drive, and roof to GR3	See Table - GR3	
3	lawn and drive as direct runoff	10,571	1,000
4	lawn and drive as direct runoff	8,516	1,000
5	lawn and drive as direct runoff	8,364	1,000
6	lawn and drive as direct runoff	8,713	1,000
7	lawnand drive as direct runoff	7,963	1,000
8	partial lawn as direct runoff	7,329	---
9	lawn, drive, and roof to street	---	---
10	lawn and drive as direct runoff - roof to GR6	7,543	1,000
11	lawn and drive as direct runoff - roof to GR7B	7,508	1,000
12	lawn and drive to GR7A - roof to street	See Table - GR7A	
13	lawn and drive as direct runoff - roof to GR7B	7,573	1,000
14	lawn and drive as direct runoff - roof to GR8	7,516	1,000
15	lawn and drive as direct runoff - roof to GR8	7,913	1,000
16	lawn and drive as direct runoff - roof to GR9	8,298	1,000
32	lawn and drive as direct runoff - roof to GR11	7,828	1,000
33 to 38	See Table	GR1E to GR1A	
39	roof and partial lawn to GR2	See Table - GR2	
40	partial lawn as direct runoff	7,329	---
41	partial lawn as direct runoff	4,615	---
42	partial lawn as direct runoff	4,885	---

Note: Not all the systems are modeled in HCAD since some with one or two roof areas are repetitive and would have the same output.


CB Y11
Lots - piped to wetland
Y-11
Lot (roof only) - piped to wetland
L32
North lot to Wetland A (roof only)
CB Y1
CB Y-1A
CB Y-1B
CB Y-1C
CB Y-1D
CB Y-1E
Lots - piped to wetland
L33
L34
L35
L36
L37
L38
North lots to Wetland A
L39
North lot to Wetland C
L37-38
Lots 37 & 38 to Wetland B
L40
North lot to Wetland C
CB Y-2A
Lot 36 - piped to wetland
CB Y-1B
Lot 16 - piped to wetland
CB Y-2B
Add Lot 40 - piped to wetland
CB Y10
CB Y2
Lots - piped to wetland
CB Y3
CB Y-3A
Lot 3- piped to wetland
L3
Lot 3 to Wetland A
CB Y-3B
Lot 2 - piped to wetland
L2
Lot 2 to Wetland A
n=.30
Simulate spill from rock trench
30 LF
Simulate spill from rock trench
CB Y9
CB Y-9
Lot 16 - piped to wetland
L16
Lot 16 to Wetland B
Subcat
Reach
Pond
Link
Routing Diagram for Parklands - Rear Yards to wetlands - n=0.30 - Final
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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CB Y1
CB Y-1A
CB Y-1B
CB Y-1C
CB Y-1D
CB Y-1E
Lots - piped to wetland
Lots - piped to wetland
Lots - piped to wetland
Lots - piped to wetland
Lots - piped to wetland
Lots - piped to wetland
L33
L34
L35
L36
L37
L38
North lots to Wetland A
North lots to Wetland A
North lots to Wetland A
North lots to Wetland A
North lots to Wetland A
North lots to Wetland A
Subcat
Reach
Pond
Link
Routing Diagram for Parklands - Rear Yards to wetlands - n=0.30 - Final
Prepared by Hewlett-Packard Company, Printed 10/13/2016
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Summary for Subcatchment L33: North lots to Wetland A

Runoff = 0.08 cfs @ 7.99 hrs, Volume= 0.029 af, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.96"

	Area (sf)	CN	Description
*	6,500	98	Impervious (roof)
*	6,016	83	Remaing lawn
	12,516	91	Weighted Average
	6,016	83	48.07% Pervious Area
	6,500	98	51.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Assumed**

Summary for Subcatchment L34: North lots to Wetland A

Runoff = 0.08 cfs @ 7.99 hrs, Volume= 0.027 af, Depth> 1.29"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.96"

	Area (sf)	CN	Description
*	6,500	98	Impervious (roof)
*	4,612	83	Remaing lawn
	11,112	92	Weighted Average
	4,612	83	41.50% Pervious Area
	6,500	98	58.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Assumed**

Summary for Subcatchment L35: North lots to Wetland A

Runoff = 0.08 cfs @ 7.99 hrs, Volume= 0.027 af, Depth> 1.29"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.96"

	Area (sf)	CN	Description
*	6,500	98	Impervious (roof)
*	4,603	83	Remaing lawn
	11,103	92	Weighted Average
	4,603	83	41.46% Pervious Area
	6,500	98	58.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Assumed**

Summary for Subcatchment L36: North lots to Wetland A

Runoff = 0.08 cfs @ 7.99 hrs, Volume= 0.027 af, Depth> 1.29"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.96"

	Area (sf)	CN	Description
*	6,500	98	Impervious (roof)
*	4,596	83	Remaing lawn
	11,096	92	Weighted Average
	4,596	83	41.42% Pervious Area
	6,500	98	58.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Assumed**

Summary for Subcatchment L37: North lots to Wetland A

Runoff = 0.08 cfs @ 7.99 hrs, Volume= 0.028 af, Depth> 1.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.96"

	Area (sf)	CN	Description
*	6,500	98	Impervious (roof)
*	4,973	83	Remaing lawn
	11,473	91	Weighted Average
	4,973	83	43.35% Pervious Area
	6,500	98	56.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Assumed**

Summary for Subcatchment L38: North lots to Wetland A

Runoff = 0.08 cfs @ 7.99 hrs, Volume= 0.030 af, Depth> 1.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.96"

	Area (sf)	CN	Description
*	6,500	98	Impervious (roof) composite for unconnected
*	7,044	83	Remaining lawn
	13,544	90	Weighted Average
	7,044	83	52.01% Pervious Area
	6,500	98	47.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Assumed**

Summary for Pond Y-1A: Lots - piped to wetland

Inflow Area = 1.626 ac, 55.05% Impervious, Inflow Depth > 1.25" for WQ event
Inflow = 0.46 cfs @ 7.99 hrs, Volume= 0.169 af
Outflow = 0.46 cfs @ 7.99 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 7.99 hrs, Volume= 0.169 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 190.28' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	189.61'	**10.0" Round Culvert** L= 90.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 189.61' / 189.16' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf

Primary OutFlow Max=0.46 cfs @ 7.99 hrs HW=190.28' TW=190.15' (Fixed TW Elev= 190.15')
↑—**1=Culvert** (Outlet Controls 0.46 cfs @ 1.34 fps)

Summary for Pond Y-1B: Lots - piped to wetland

Inflow Area = 1.084 ac, 55.07% Impervious, Inflow Depth > 1.25" for WQ event
Inflow = 0.31 cfs @ 7.99 hrs, Volume= 0.113 af
Outflow = 0.31 cfs @ 7.99 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min
Primary = 0.31 cfs @ 7.99 hrs, Volume= 0.113 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 191.08' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	190.75'	**8.0" Round Culvert** L= 95.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 190.75' / 189.99' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=0.31 cfs @ 7.99 hrs HW=191.08' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.31 cfs @ 2.57 fps)

Summary for Pond Y-1C: Lots - piped to wetland

Inflow Area = 0.829 ac, 54.00% Impervious, Inflow Depth > 1.24" for WQ event
Inflow = 0.23 cfs @ 7.99 hrs, Volume= 0.086 af
Outflow = 0.23 cfs @ 7.99 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 0.23 cfs @ 7.99 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 191.85' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	191.56'	**8.0" Round Culvert** L= 102.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 191.56' / 190.75' S= 0.0079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=0.23 cfs @ 7.99 hrs HW=191.85' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.23 cfs @ 2.39 fps)

Summary for Pond Y-1D: Lots - piped to wetland

Inflow Area = 0.574 ac, 51.96% Impervious, Inflow Depth > 1.22" for WQ event
Inflow = 0.16 cfs @ 7.99 hrs, Volume= 0.058 af
Outflow = 0.16 cfs @ 7.99 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min
Primary = 0.16 cfs @ 7.99 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 192.61' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	192.38'	**8.0" Round Culvert** L= 102.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 192.38' / 191.56' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=0.16 cfs @ 7.99 hrs HW=192.61' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.16 cfs @ 2.16 fps)

Summary for Pond Y-1E: Lots - piped to wetland

Inflow Area = 0.311 ac, 47.99% Impervious, Inflow Depth > 1.17" for WQ event
Inflow = 0.08 cfs @ 7.99 hrs, Volume= 0.030 af
Outflow = 0.08 cfs @ 7.99 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
Primary = 0.08 cfs @ 7.99 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 193.42' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	193.25'	**8.0" Round Culvert** L= 109.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 193.25' / 192.38' S= 0.0080 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=0.08 cfs @ 7.99 hrs HW=193.42' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.08 cfs @ 1.79 fps)

Summary for Pond Y1: Lots - piped to wetland

Inflow Area = 1.626 ac, 55.05% Impervious, Inflow Depth > 1.25" for WQ event
Inflow = 0.46 cfs @ 7.99 hrs, Volume= 0.169 af
Outflow = 0.46 cfs @ 7.99 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 7.99 hrs, Volume= 0.169 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 190.15' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	189.99'	**Tube/Siphon/Float Valve X 0.00** Discharges@189.99' 8.000" Diameter, C= 0.600 90.0' Long Tube, Hazen-Williams C= 130
#2	Primary	189.99'	**Special & User-Defined -Perf at 50% clogged** Head (feet) 0.00 0.17 0.50 0.67 Disch. (cfs) 0.000 0.480 1.850 2.745

Primary OutFlow Max=0.46 cfs @ 7.99 hrs HW=190.15' (Free Discharge)
├**1=Tube/Siphon/Float Valve** (Controls 0.00 cfs)
└**2=Special & User-Defined -Perf at 50% clogged** (Custom Controls 0.46 cfs)

APPENDIX E

Appendix E Appurtenances

E-1 Pipe Capacity and Velocity Calcs.

E-2 Catch Basin Design Comments

E-3 Energy Dissipator Manhole Design

E-4 Flow Dispersion System – Line A and Line C

APPENDIX E-1 INLET CACITY SUMMARY TABLE
10-YR EVENT

INLET CAPACITY CHECK - TR 55 METHODOLOGY

Inlet No.	Subcat ID	Location/ Station	Inlet Type	Inlet Condition	Long. Slope (ft/ft)	Flow to Inlet Q (cfs)	Bypass Inflow Q_B (cfs)	Total Inflow Q_T (cfs)	Intercept Flow Q_I (cfs)	Bypass Flow Q_B (cfs)	Bypass to Inlet No.	Spread T (ft)	Depth at Curb* (ft) (*less 1 inch)	Depth at Curb (ft) Include Depression
PARKLANDS (10-YR EVENT)														
PF-1A	E1, E1-9	Longbow Ln.	2' x 2'	OG	0.0320	0.23	0.00	0.23	0.23	0.00	N/A	1.80	0.02	0.10
PF-1B	G1, GN	Longbow Ln.	2' x 2'	LP	0.0030	0.64	0.00	0.64	0.64	0.00	N/A	1.83	0.02	0.10
PF-2	G2, GS	Longbow Ln.	2' x 2'	LP	0.0030	0.51	0.00	0.51	0.51	0	N/A	in gutter	0.00	0.07
PF-3	E3	McMaster Dr.	2' x 2'	LP	0.0030	0.28	0.00	0.28	0.28	0.00	N/A	in gutter	0.00	0.07
PF-4	E4	McMaster Dr.	2' x 2'	LP	0.0030	0.38	0.03	0.41	0.34	0.01	N/A	in gutter	0.00	0.07
PF-5	E5L,E5R	McMaster Dr.	2' x 2'	LP	0.0030	1.05	0.03	1.08	1.08	0	N/A	3.75	0.06	0.14
PF-6	E6	McMaster Dr.	2' x 2'	OG	0.0100	0.30	0.03	0.33	0.30	0.03	PF5	3.74	0.07	0.15
PF-7	E7	McMaster Dr.	2' x 2'	OG	0.0100	0.30	0.03	0.33	0.30	0.03	PF4	3.74	0.07	0.15
PF-8	E8	McMaster Dr.	2' x 2'	OG	0.0100	0.32	0.00	0.32	0.29	0.03	PF6	3.67	0.07	0.15
PF-9	E9	McMaster Dr.	2' x 2'	OG	0.0100	0.32	0.00	0.32	0.29	0.03	PF7	3.67	0.07	0.15
PF-15	A3	Pittock Place	2' x 2'	LP	0.0030	0.54	0.00	0.54	0.54	0.00	N/A	1.19	0.01	0.09
PF-18	CWS	Camas Meadows Drive	2' x 2'	LP	0.0030	0.50	0.00	0.50	0.50	0.00	N/A	in gutter	0.00	0.08
PF-19	CWN	Camas Meadows Drive	2' x 2'	LP	0.0030	0.39	0.00	0.39	0.39	0.00	N/A	in gutter	0.00	0.07
PF-20	CES	Camas Meadows Drive	2' x 2'	LP	0.0030	0.45	0.00	0.45	0.45	0.00	N/A	in gutter	0.00	0.07
PF-21	CEN	Camas Meadows Drive	2' x 2'	LP	0.0030	0.48	0.00	0.48	0.48	0.00	N/A	in gutter	0.00	0.08

Date: 14-Aug-16 Width of local depression: 12 inches Precipitation: 10-yr

Designed By: GME Amount of local depression (in): 1 inch below street cross-slope at gutter line

Checked By: GME * Depth of flow at curb measured from the normal cross slope

APP E-1 SECTION 2

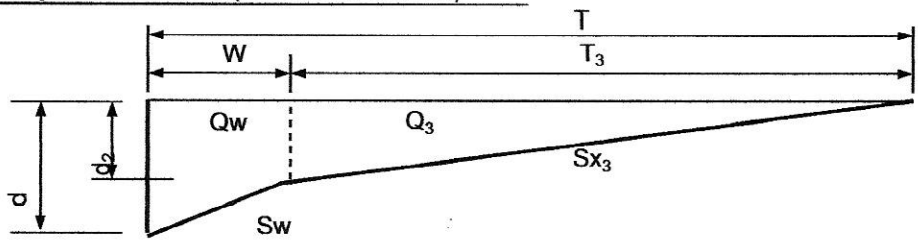
Job Name: **PARLANDS**
Job Number:
Date: 9/7/16 10:00 AM
Inlet Location: LONGBOW LN PF-1A

Design Values
Results

Note: Spread is based on conditions at a Combination Curb Inle

Flow Spread in Gutters

From ODOT Hydraulics Manual (3.3 *Flow in Gutters*)



$Q_3 = (0.56/n*Sx_3)*S^{1/2}(d_2^{2.67})$

$Qw = (0.56/n*Sw)S^{1/2}(d^{2.67}-d_2^{2.67})$

Where: $d = T_3*Sx_3+W*S_3$

$d = T_3*Sx_3$

$Q = Q_3+Qw$

$V = 2*Q/(T_3^{2}*Sx_3+W\text{^}2*Sw+2*W*T_3*Sx_3)$

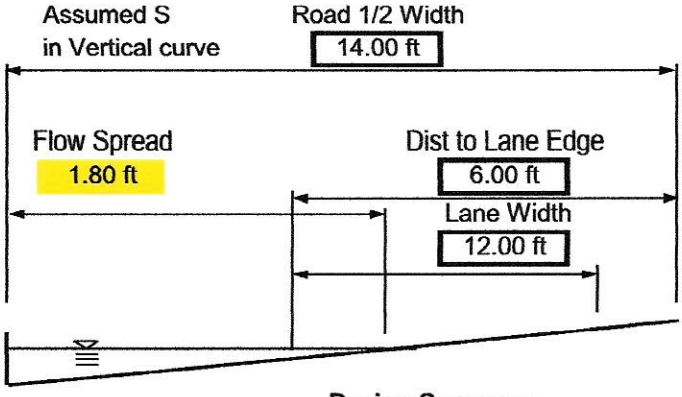
Where:

Q = Total gutter flow (cfs)
Q_1, Q_2, Q1 = Partial gutter flow (cfs)
Qw = Depressed gutter flow (cfs)
n = Manning's "n" value
Sx, Sx_1, Sx_2 = Gutter cross slope (ft/ft)
S = Longitudinal gutter slope (ft/ft)
(For sump locations S=0.3%, HEC 12, Pg 72)

T, T_1, T_2 = Flow width in gutter (ft)
V = Average gutter flow velocity (fps)
d = Flow depth at curb (ft)
d_2 = Flow depth at break in cross slope
Sw = Depressed gutter cross slope (ft/ft
W = Depressed gutter width (ft)

Assumed S - it is in vertical curve section

Q =	0.23 cfs		Sx_3 =	2.00%	Pavement X-Slope
S =	3.20%	(Longitudinal)	W =	1.00 ft	Gutter Width
n =	0.015		Sw =	10.50%	Gutter X-Slope



Design Summary

Flow Spread in Travel Lane	0.00 ft	Flow does not enter lane :: Design OK
Depth at Edge of Travel Lane	0.00 ft	Water does not enter travel lane. :: Design Ok

Job Name: **PARLANDS**
Job Number:
Date: 9/7/16 10:00 AM
Inlet Location: LONGBOW LN PF-1A

Design Values
Results

			Check
Flow Spread (T) =	1.80 ft	d = 0.12 ft	0.12
Q =	0.23 cfs		
S =	3.20%	V = 2.14 fps	
Sx =	2.00%		
n =	0.015		
a=	1.000		

Note: Flow spread is based on conditions at grate section

Grated Inlet Capacity Against a Curb, Ongrade Condition

Grate dimensions are for Combination Curb Inlet

Note: HEC-12, CH 7.4 states that combination curb inlets should be analysized ignoring the curb opening. Therefore, this spreadsheet also applies to combination curb inlets.

FROM HEC-12

(Eq 7) Eo = 1 - (1 - W/T)^2.67

Where:

Eo = Ratio of frontal flow intercepted to total frontal flow
W = Grate width (1.67' for herringbone pattern)
T = Total flow spread

L= disance along curb face

W = dist. from curb to outer edge of grate

W = 2.00 ft **Eo =** 100%

(Eq 9) Rf = 1 - 0.09*(V - Vo)

Where:

Rf = Ratio of frontal flow intercepted to total frontal flow
V = Velocity of flow
Vo = Splash-over Velocity (5 fps for herringbone pattern grate, WSDOT)

Vo = 5.00 fps **Rf =** 100%
Qif = 0.23 cfs

(Eq 8) Qs/Q = 1 - Eo

Where:

Qs/Q = Ratio of side flow to total flow **Qs/Q =** 0%

(Eq 10) Rs = 1 / (1 + (0.15*V^1.18)/(Sx*L^2.3))

Where:

Rs = Ratio of side flow intercepted to total side flow
L = Grate length (2.00' for herringbone pattern)

L= disance along curb face

W = dist. from curb to outer edge of grate

L = 2.00 ft **Rs =** 14%
Qis = 0.00 cfs

Grate Summary

Qi =	0.23 cfs	
Qbp =	0.00 cfs	(Flow Bypassed)
E =	100%	Grate efficiency

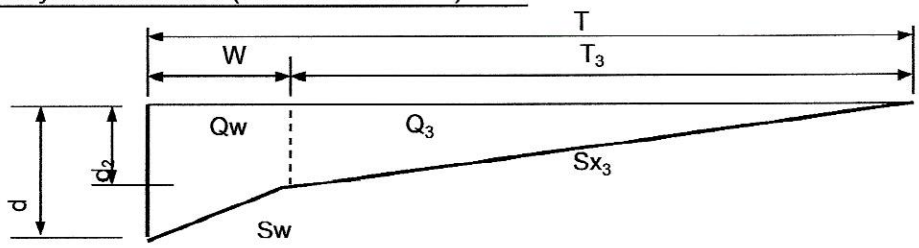
Job Name: **PARLANDS**
Job Number:
Date: 8/14/16 9:06 AM
Inlet Location: MCMASTER DR (PF-6 and PF-7 Note: Both have same inflow.

Design Values
Results

Note: Spread is based on conditions at a Combination Curb Inle

Flow Spread in Gutters

From ODOT Hydraulics Manual (3.3 *Flow in Gutters*)



$Q_3 = (0.56/n*Sx_3)*S^{1/2}(d_2^{2.67})$

$Qw = (0.56/n*Sw)S^{1/2}(d^{2.67}-d_2^{2.67})$

Where: $d = T_3*Sx_3+W*S_3$

$d = T_3*Sx_3$

$Q = Q_3+Qw$

$V = 2*Q/(T_3^{2}*Sx_3+W^2*Sw+2*W*T_3*Sx_3)$

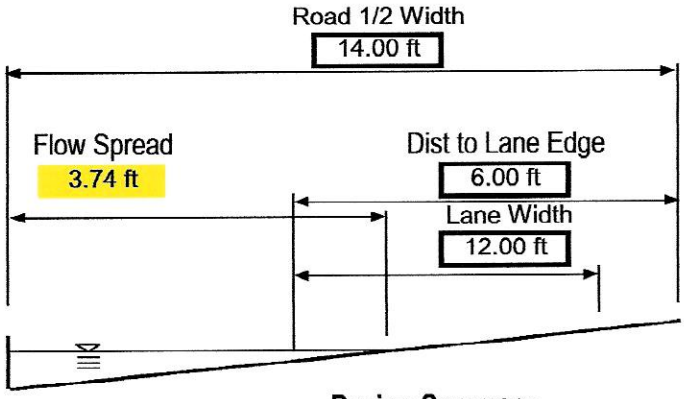
Where:

Q = Total gutter flow (cfs)
Q_1, Q_2, Q1 = Partial gutter flow (cfs)
Qw = Depressed gutter flow (cfs)
n = Manning's "n" value
Sx, Sx_1, Sx_2 = Gutter cross slope (ft/ft)
S = Longitudinal gutter slope (ft/ft)
(For sump locations S=0.3%, HEC 12, Pg 72)

T, T_1, T_2 = Flow width in gutter (ft)
V = Average gutter flow velocity (fps)
d = Flow depth at curb (ft)
d_2 = Flow depth at break in cross slope
Sw = Depressed gutter cross slope (ft/ft
W = Depressed gutter width (ft)

Note: Include bypass flow from PF-8 and PF-9 (0.03 cfs each)

Q =	0.33 cfs		Sx_3 =	2.00%	Pavement X-Slope
S =	1.00%	(Longitudinal)	W =	1.00 ft	Gutter Width
n =	0.015		Sw =	10.50%	Gutter X-Slope



Design Summary

Flow Spread in Travel Lane	0.00 ft	Flow does not enter lane :: Design OK
Depth at Edge of Travel Lane	0.00 ft	Water does not enter travel lane. :: Design Ok

Job Name: **PARLANDS**
Job Number:
Date: 8/14/16 9:06 AM
Inlet Location: MCMASTER DR (PF-6 and PF-7

Design Values
Results

Flow Spread (T) = 3.74 ft
Q = 0.33 cfs
S = 1.00%
Sx = 2.00%
n = 0.015
a= 1.000

d = 0.16 ft Check 0.16

V = 1.12 fps

Note: Flow spread is based on conditions at grate section

Grated Inlet Capacity Against a Curb, Ongrade Condition

Grate dimensions are for Combination Curb Inlet

Note: HEC-12, CH 7.4 states that combination curb inlets should be analysized ignoring the curb opening. Therefore, this spreadsheet also applies to combination curb inlets.

FROM HEC-12

(Eq 7) Eo = 1 - (1 - W/T)^2.67

Where:

Eo = Ratio of frontal flow intercepted to total frontal flow
W = Grate width (1.67' for herringbone pattern)
T = Total flow spread

L= disance along curb face

W = dist. from curb to outer edge of grate

W = 2.00 ft **Eo =** 87%

(Eq 9) Rf = 1 - 0.09*(V - Vo)

Where:

Rf = Ratio of frontal flow intercepted to total frontal flow
V = Velocity of flow
Vo = Splash-over Velocity (5 fps for herringbone pattern grate, WSDOT)

Vo = 5.00 fps **Rf =** 100%
Qif = 0.29 cfs

(Eq 8) Qs/Q = 1 - Eo

Where:

Qs/Q = Ratio of side flow to total flow **Qs/Q =** 13%

(Eq 10) Rs = 1 / (1 + (0.15*V^1.18)/(Sx*L^2.3))

Where:

Rs = Ratio of side flow intercepted to total side flow
L = Grate length (2.00' for herringbone pattern)

L= disance along curb face

W = dist. from curb to outer edge of grate

L = 2.00 ft **Rs =** 35%
Qis = 0.01 cfs

Grate Summary

Qi = 0.30 cfs
Qbp = 0.03 cfs (Flow Bypassed)
E = 92% Grate efficiency

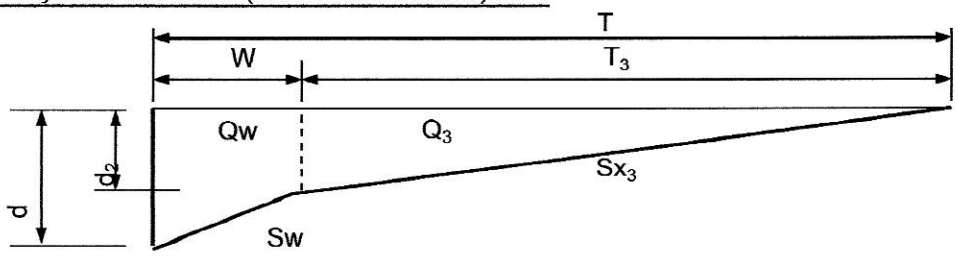
Job Name: **PARLANDS**
Job Number:
Date: 8/14/16 9:06 AM
Inlet Location: MCMASTER DR (PF-8 and PF-9 Note: Both have same inflow.

Design Values
Results

Note: Spread is based on conditions at a Combination Curb Inl

Flow Spread in Gutters

From ODOT Hydraulics Manual (3.3 *Flow in Gutters*)



$Q_3 = (0.56/n*Sx_3)*S^{1/2}(d_2^{2.67})$

$Qw = (0.56/n*Sw)S^{1/2}(d^{2.67}-d_2^{2.67})$

Where: $d = T_3*Sx_3+W*S_3$

$d = T_3*Sx_3$

$Q = Q_3+Qw$

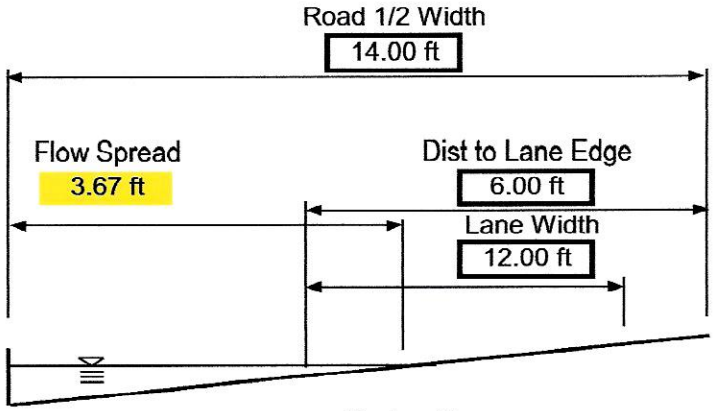
$V = 2*Q/(T_3^2*Sx_3+W\text{^}2*Sw+2*W*T_3*Sx_3)$

Where:

Q = Total gutter flow (cfs)
Q_1, Q_2, Q1 = Partial gutter flow (cfs)
Qw = Depressed gutter flow (cfs)
n = Manning's "n" value
Sx, Sx_1, Sx_2 = Gutter cross slope (ft/ft)
S = Longitudinal gutter slope (ft/ft)
(For sump locations S=0.3%, HEC 12, Pg 72)

T, T_1, T_2 = Flow width in gutter (ft)
V = Average gutter flow velocity (fps)
d = Flow depth at curb (ft)
d_2 = Flow depth at break in cross slope
Sw = Depressed gutter cross slope (ft/ft
W = Depressed gutter width (ft)

Q =	0.32 cfs		Sx_3 =	2.00%	Pavement X-Slope
S =	1.00%	(Longitudinal)	W =	1.00 ft	Gutter Width
n =	0.015		Sw =	10.50%	Gutter X-Slope



Design Summary

Flow Spread in Travel Lane	0.00 ft	Flow does not enter lane :: Design OK
Depth at Edge of Travel Lane	0.00 ft	Water does not enter travel lane. :: Design O

Job Name: **PARLANDS**
Job Number: 0
Date: 8/14/16 9:06 AM
Inlet Location: MCMASTER DR (PF-8 and PF-9

Design Values
Results

Flow Spread (T) = 3.67 ft
Q = 0.32 cfs
S = 1.00%
Sx = 2.00%
n = 0.015
a= 1.000

d = 0.16 ft 0.16

V = 1.11 fps

Note: Flow spread is based on conditions at grate section

Grated Inlet Capacity Against a Curb, Ongrade Condition

Grate dimensions are for Combination Curb Inlet

Note: HEC-12, CH 7.4 states that combination curb inlets should be analysized ignoring the curb opening. Therefore, this spreadsheet also applies to combination curb inlets.

FROM HEC-12

(Eq 7) Eo = 1 - (1 - W/T)^2.67

Where:

Eo = Ratio of frontal flow intercepted to total frontal flow
W = Grate width (1.67' for herringbone pattern)
T = Total flow spread

L= disance along curb face

W = dist. from curb to outer edge of grate

W = 2.00 ft **Eo =** 88%

(Eq 9) Rf = 1 - 0.09*(V - Vo)

Where:

Rf = Ratio of frontal flow intercepted to total frontal flow
V = Velocity of flow
Vo = Splash-over Velocity (5 fps for herringbone pattern grate, WSDOT)

Vo = 5.00 fps **Rf =** 100%
Qif = 0.28 cfs

(Eq 8) Qs/Q = 1 - Eo

Where:

Qs/Q = Ratio of side flow to total flow **Qs/Q =** 12%

(Eq 10) Rs = 1 / (1 + (0.15*V^1.18)/(Sx*L^2.3))

Where:

Rs = Ratio of side flow intercepted to total side flow
L = Grate length (2.00' for herringbone pattern)

L= disance along curb face

W = dist. from curb to outer edge of grate

L = 2.00 ft **Rs =** 35%
Qis = 0.01 cfs

Grate Summary

Qi = 0.29 cfs
Qbp = 0.03 cfs (Flow Bypassed)
E = 92% Grate efficiency

Job Name: _____
Job Number: _____
Date: 8/14/16 8:59 AM

Grated Inlet Capacity in a Sump Condition (SAG)

Reference: MODOT

640.1.5.2 Capacity of Grate Inlets Located at Low Points in Grade

A grate type drop inlet located at a low point in grade will behave either as a weir or as an orifice, dependent upon the depth of water at the grate. The capacity is independent of the geometric configuration of the grate.

For depths of water less than 0.4 ft. (120 mm), the capacity is governed by weir flow and may be calculated by the following equation:

$$Q_i = C_w p d^{1.5}$$

where:

Q_i = inlet capacity, ft^3/s (m^3/s)

C_w = constant, 3.0 - ENGLISH (1.66 - METRIC)

p = effective perimeter of the grate, ft. (m)

d = depth of water above the top of the grate, ft. (m)

The **effective perimeter** can be calculated using

(when there is a curb) $p = 2w + l$

(when there is no curb) $p = 2(w + l)$

where:

p = effective perimeter of the grate, ft. (m)

w = width of opening, ft. (m)

l = length of opening, ft. (m)

Only that portion of the grate's perimeter along which flow enters the inlet is considered when determining the effective perimeter.

When the depth of water exceeds 1.4 ft. (420 mm), the grate capacity is governed by orifice flow and may be calculated by the following equation

$$Q_i = C_o A (2gd)^{0.5}$$

where:

Q_i = inlet capacity, ft^3/s (m^3/s)

C_o = orifice coefficient = 0.67

A = clear opening area of the grate, ft^2 (m^2)

g = 32.2 ft/s^2 (9.80 m/s^2)

d = depth of water above the top of the grate, ft. (m)

Reference: HEC-22

Use of equation 4-27 requires the clear area of opening of the grate. Tests of three grates for the Federal Highway Administration (27) showed that for flat bar grates, such as the P-50x100 and P-30 grates, the clear opening is equal to the total area of the grate less the area occupied by longitudinal and lateral bars.

The curved vane grate performed about 10 percent better than a grate with a net opening equal to the total area less the area of the bars projected on a horizontal plane. That is, the projected area of the bars in a curved vane grate is 68 percent of the total area of the grate leaving a net opening of 32 percent, however the grate performed as a grate with a net opening of 35 percent.

Tilt-bar grates were not tested, but exploration of the above results would indicate a net opening area of 34 percent for the 30-degree tilt-bar and zero for the 45-degree tilt-bar grate. Obviously, the 45-degree tilt-bar grate would have greater than zero capacity.

Tilt-bar and curved vane grates are not recommended for sump locations where there is a chance that operation would be as an orifice.

Job Name: **Parklands**
Job Number:
Date: 8/16/16 2:35 PM
Perk Filter PF-2 and PF-1B

Note: Include print of desgn info sheet

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)
$Q = CwPd^{1.5}$
Where:
Cw = 3.0
P = Perimeter of grate (Excluding sides against curbs)
d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)
$Q = CoA(2gd)^{0.5}$
Where:
Co = 0.67
A = Clear opening area of grate
g = 32.16 ft/s^2
d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Grate (Effective Length) Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

See Fig. 5-5 (Hydraulics Manual, 1997)
35% for vaned

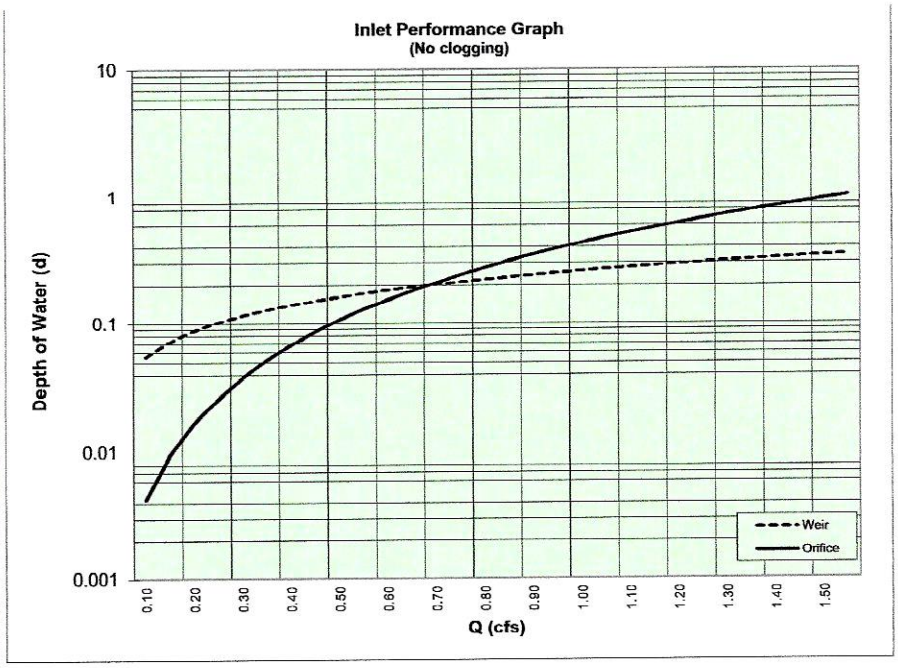
Standard Inlet Specifications	Effective Dimensions Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.50 cfs
Table Increment: 0.01 cfs

PF-2 = 0.51
PF-1B = 0.64
CB#: PF-1B - 10yr
Actual Q: 0.64 cfs
Depth weir: 0.10 ft

Depth orifice: 0.03 ft
Controlling Depth: 0.10 ft

Inlet Performance Table Q	d_{weir}	$d_{orifice}$
0.50 cfs	0.08 ft	0.02 ft
0.51 cfs	0.08 ft	0.02 ft
0.52 cfs	0.08 ft	0.02 ft
0.53 cfs	0.09 ft	0.02 ft
0.54 cfs	0.09 ft	0.02 ft
0.55 cfs	0.09 ft	0.02 ft
0.56 cfs	0.09 ft	0.03 ft
0.57 cfs	0.09 ft	0.03 ft
0.58 cfs	0.09 ft	0.03 ft
0.59 cfs	0.09 ft	0.03 ft
0.60 cfs	0.09 ft	0.03 ft
0.61 cfs	0.09 ft	0.03 ft
0.62 cfs	0.10 ft	0.03 ft
0.63 cfs	0.10 ft	0.03 ft
0.64 cfs	0.10 ft	0.03 ft
0.65 cfs	0.10 ft	0.03 ft
0.66 cfs	0.10 ft	0.04 ft
0.67 cfs	0.10 ft	0.04 ft
0.68 cfs	0.10 ft	0.04 ft
0.69 cfs	0.10 ft	0.04 ft
0.70 cfs	0.10 ft	0.04 ft
0.71 cfs	0.10 ft	0.04 ft
0.72 cfs	0.11 ft	0.04 ft
0.73 cfs	0.11 ft	0.04 ft
0.74 cfs	0.11 ft	0.04 ft
0.75 cfs	0.11 ft	0.05 ft
0.76 cfs	0.11 ft	0.05 ft
0.77 cfs	0.11 ft	0.05 ft
0.78 cfs	0.11 ft	0.05 ft
0.79 cfs	0.11 ft	0.05 ft



Subcatchment #'s	Sumped Inlet #	Total Q (cfs)	Controlling Depth		Flow Spread	Road Cross
PF2	PF-2	0.51	0.08	weir	within gutter	2.00%
			0.03	orifice	within gutter	2.00%
PF1B	PF-1B	0.64	0.10	weir	1.83	2.00%
			0.00	orifice	within gutter	2.00%

Job Name: **Parklands**
Job Number:
Date: 8/14/16 7:52 PM
Perk Filter PF-3

Note: Include print of desgn info sheet

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)
$Q = CwPd^{1.5}$
Where:
Cw = 3.0
P = Perimeter of grate (Excluding sides against curbs)
d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)
$Q = CoA(2gd)^{0.5}$
Where:
Co = 0.67
A = Clear opening area of grate
g = 32.16 ft/s^2
d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Grate (Effective Length) Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

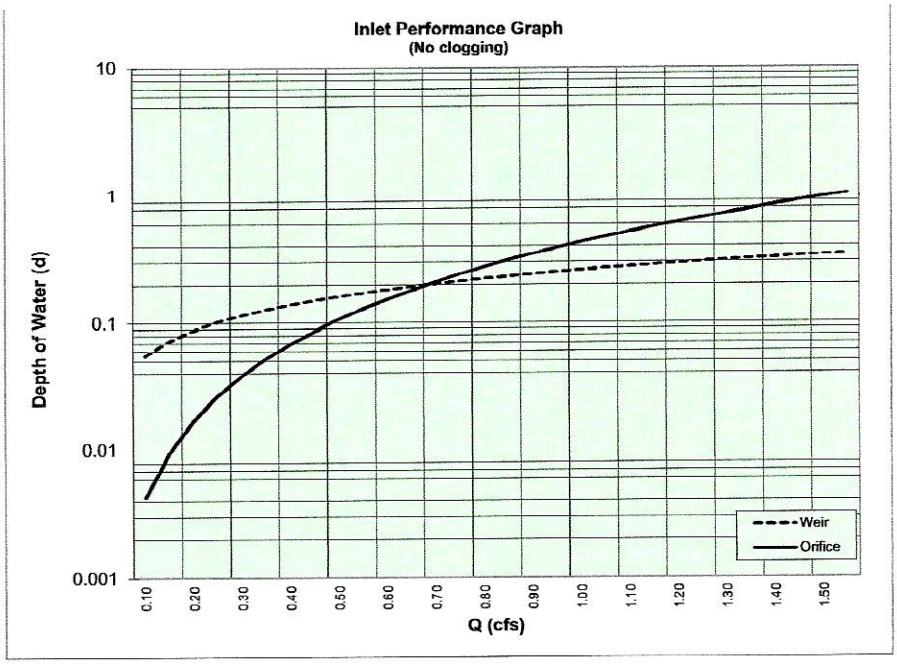
See Fig. 5-5 (Hydraulics Manual, 1997) — 35% for vaned

Standard Inlet Specifications	Effective Dimensions Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.20 cfs
Table Increment: 0.01 cfs

CB#: PF-3 - 10yr
Actual Q: 0.28 cfs
Depth weir: 0.05 ft
Depth orifice: 0.01 ft
Controlling Depth: 0.05 ft

Inlet Performance Table		
Q	d_{weir}	$d_{orifice}$
0.20 cfs	0.04 ft	0.00 ft
0.21 cfs	0.05 ft	0.00 ft
0.22 cfs	0.05 ft	0.00 ft
0.23 cfs	0.05 ft	0.00 ft
0.24 cfs	0.05 ft	0.00 ft
0.25 cfs	0.05 ft	0.01 ft
0.26 cfs	0.05 ft	0.01 ft
0.27 cfs	0.05 ft	0.01 ft
0.28 cfs	0.06 ft	0.01 ft
0.29 cfs	0.06 ft	0.01 ft
0.30 cfs	0.06 ft	0.01 ft
0.31 cfs	0.06 ft	0.01 ft
0.32 cfs	0.06 ft	0.01 ft
0.33 cfs	0.06 ft	0.01 ft
0.34 cfs	0.06 ft	0.01 ft
0.35 cfs	0.07 ft	0.01 ft
0.36 cfs	0.07 ft	0.01 ft
0.37 cfs	0.07 ft	0.01 ft
0.38 cfs	0.07 ft	0.01 ft
0.39 cfs	0.07 ft	0.01 ft
0.40 cfs	0.07 ft	0.01 ft
0.41 cfs	0.07 ft	0.01 ft
0.42 cfs	0.07 ft	0.01 ft
0.43 cfs	0.07 ft	0.02 ft
0.44 cfs	0.08 ft	0.02 ft
0.45 cfs	0.08 ft	0.02 ft
0.46 cfs	0.08 ft	0.02 ft
0.47 cfs	0.08 ft	0.02 ft
0.48 cfs	0.08 ft	0.02 ft
0.49 cfs	0.08 ft	0.02 ft



Subcatchment #'s	Sumped Inlet #	Total Q (cfs)	Controlling Depth		Flow Spread	Road Cross
PF-3	PF-3	0.28	0.05	weir	within gutter	2.00%
			0.01	orifice	within gutter	2.00%

Job Name: **Parklands** Note: Include print of desgn info sheet

Job Number:

Date: 8/14/16 7:48 PM

Perk Filter PF-4

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)

$Q = CwPd^{1.5}$

Where:

Cw = 3.0

P = Perimeter of grate (Excluding sides against curbs)

d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)

$Q = CoA(2gd)^{0.5}$

Where:

Co = 0.67

A = Clear opening area of grate

g = 32.16 ft/s^2

d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Grate (Effective Length) Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

See Fig. 5-5 (Hydraulics Manual, 1997) — 35% for vaned

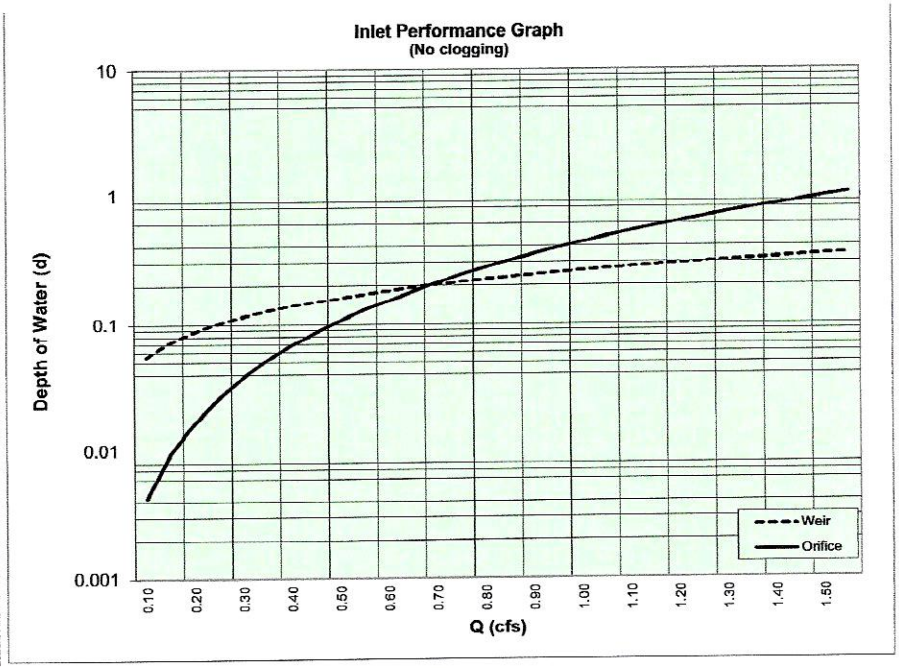
Standard Inlet Specifications	Effective Dimensions Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.30 cfs
Table Increment: 0.01 cfs

CB#: PF-4- 10yr
Actual Q: 0.38 cfs
Depth weir: 0.07 ft

Depth orifice: 0.01 ft
Controlling Depth: 0.07 ft

Inlet Performance Table		
Q	d_{weir}	$d_{orifice}$
0.30 cfs	0.06 ft	0.01 ft
0.31 cfs	0.06 ft	0.01 ft
0.32 cfs	0.06 ft	0.01 ft
0.33 cfs	0.06 ft	0.01 ft
0.34 cfs	0.06 ft	0.01 ft
0.35 cfs	0.07 ft	0.01 ft
0.36 cfs	0.07 ft	0.01 ft
0.37 cfs	0.07 ft	0.01 ft
0.38 cfs	0.07 ft	0.01 ft
0.39 cfs	0.07 ft	0.01 ft
0.40 cfs	0.07 ft	0.01 ft
0.41 cfs	0.07 ft	0.01 ft
0.42 cfs	0.07 ft	0.01 ft
0.43 cfs	0.07 ft	0.02 ft
0.44 cfs	0.08 ft	0.02 ft
0.45 cfs	0.08 ft	0.02 ft
0.46 cfs	0.08 ft	0.02 ft
0.47 cfs	0.08 ft	0.02 ft
0.48 cfs	0.08 ft	0.02 ft
0.49 cfs	0.08 ft	0.02 ft
0.50 cfs	0.08 ft	0.02 ft
0.51 cfs	0.08 ft	0.02 ft
0.52 cfs	0.08 ft	0.02 ft
0.53 cfs	0.09 ft	0.02 ft
0.54 cfs	0.09 ft	0.02 ft
0.55 cfs	0.09 ft	0.02 ft
0.56 cfs	0.09 ft	0.03 ft
0.57 cfs	0.09 ft	0.03 ft
0.58 cfs	0.09 ft	0.03 ft
0.59 cfs	0.09 ft	0.03 ft



Subcatchment #'s	Sumped Inlet #	Total Q (cfs)	Controlling Depth	Flow Spread		Road Cross
PF-4	PF-4	0.38	0.07	weir	in gutter	2.00%
			0.01	orifice	in gutter	2.00%

Job Name: **Parklands**
Job Number:
Date: 8/14/16 3:06 PM
Perk Filter PF-5

Note: Include print of desgn info sheet

Check 100-yr Flow

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)
$Q = CwPd^{1.5}$
Where:
Cw = 3.0
P = Perimeter of grate (Excluding sides against curbs)
d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)
$Q = CoA(2gd)^{0.5}$
Where:
Co = 0.67
A = Clear opening area of grate
g = 32.16 ft/s^2
d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Grate (Effective Length) Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

*Note: 50% reduction

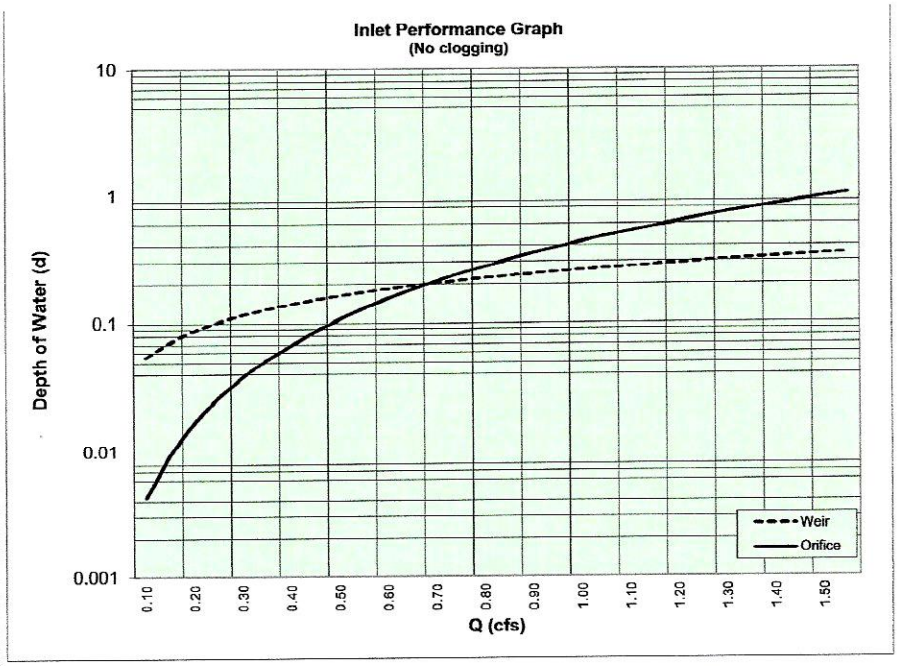
See Fig. 5-5 (Hydraulics Manual, 1997)
35% for vaned

Standard Inlet Specifications	Effective Dimensions Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.90 cfs
Table Increment: 0.01 cfs

CB#: PF-5 - 100-yr
Actual Q: 1.61 cfs
Depth weir: 0.15 ft
Depth orifice: 0.12 ft
Controlling Depth: 0.15 ft

Inlet Performance Table Q	d_{weir}	$d_{orifice}$
0.90 cfs	0.12 ft	0.07 ft
0.91 cfs	0.12 ft	0.07 ft
0.92 cfs	0.12 ft	0.07 ft
0.93 cfs	0.13 ft	0.07 ft
0.94 cfs	0.13 ft	0.07 ft
0.95 cfs	0.13 ft	0.07 ft
0.96 cfs	0.13 ft	0.08 ft
0.97 cfs	0.13 ft	0.08 ft
0.98 cfs	0.13 ft	0.08 ft
0.99 cfs	0.13 ft	0.08 ft
1.00 cfs	0.13 ft	0.08 ft
1.01 cfs	0.13 ft	0.08 ft
1.02 cfs	0.13 ft	0.09 ft
1.03 cfs	0.13 ft	0.09 ft
1.04 cfs	0.13 ft	0.09 ft
1.05 cfs	0.14 ft	0.09 ft
1.06 cfs	0.14 ft	0.09 ft
1.07 cfs	0.14 ft	0.09 ft
1.08 cfs	0.14 ft	0.10 ft
1.09 cfs	0.14 ft	0.10 ft
1.10 cfs	0.14 ft	0.10 ft
1.11 cfs	0.14 ft	0.10 ft
1.12 cfs	0.14 ft	0.10 ft
1.13 cfs	0.14 ft	0.10 ft
1.14 cfs	0.14 ft	0.11 ft
1.15 cfs	0.14 ft	0.11 ft
1.16 cfs	0.15 ft	0.11 ft
1.17 cfs	0.15 ft	0.11 ft
1.18 cfs	0.15 ft	0.11 ft
1.19 cfs	0.15 ft	0.12 ft



Subcatchment #'s	Sumped Inlet #	Total Q (cfs)	Controlling Depth		Flow Spread	Road Cross
PF-5	PF-5	1.61	0.15	weir	7.38	2.00%
			0.12	orifice	5.80	2.00%

Job Name: **Parklands**
Job Number:
Date: 8/14/16 7:49 PM
Perk Filter PF-5

Note: Include print of desgn info sheet

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)
$Q = CwPd^{1.5}$
Where:
Cw = 3.0
P = Perimeter of grate (Excluding sides against curbs)
d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)
$Q = CoA(2gd)^{0.5}$
Where:
Co = 0.67
A = Clear opening area of grate
g = 32.16 ft/s^2
d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Grate (Effective Length) Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

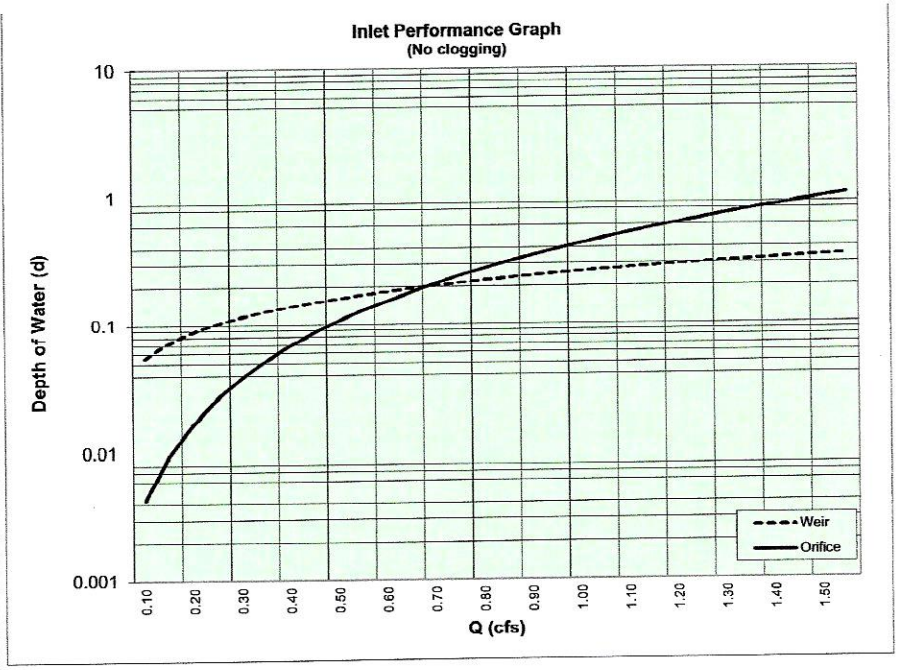
See Fig. 5-5 (Hydraulics Manual, 1997)
35% for vaned

Standard Inlet Specifications	Effective Dimensions: Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.90 cfs
Table Increment: 0.01 cfs

CB#: PF-5 - 10yr
Actual Q: 1.08 cfs
Depth weir: 0.14 ft
Depth orifice: 0.10 ft
Controlling Depth: 0.14 ft

Inlet Performance Table		
Q	d_{weir}	$d_{orifice}$
0.90 cfs	0.12 ft	0.07 ft
0.91 cfs	0.12 ft	0.07 ft
0.92 cfs	0.12 ft	0.07 ft
0.93 cfs	0.13 ft	0.07 ft
0.94 cfs	0.13 ft	0.07 ft
0.95 cfs	0.13 ft	0.07 ft
0.96 cfs	0.13 ft	0.08 ft
0.97 cfs	0.13 ft	0.08 ft
0.98 cfs	0.13 ft	0.08 ft
0.99 cfs	0.13 ft	0.08 ft
1.00 cfs	0.13 ft	0.08 ft
1.01 cfs	0.13 ft	0.08 ft
1.02 cfs	0.13 ft	0.09 ft
1.03 cfs	0.13 ft	0.09 ft
1.04 cfs	0.13 ft	0.09 ft
1.05 cfs	0.14 ft	0.09 ft
1.06 cfs	0.14 ft	0.09 ft
1.07 cfs	0.14 ft	0.09 ft
1.08 cfs	0.14 ft	0.10 ft
1.09 cfs	0.14 ft	0.10 ft
1.10 cfs	0.14 ft	0.10 ft
1.11 cfs	0.14 ft	0.10 ft
1.12 cfs	0.14 ft	0.10 ft
1.13 cfs	0.14 ft	0.10 ft
1.14 cfs	0.14 ft	0.11 ft
1.15 cfs	0.14 ft	0.11 ft
1.16 cfs	0.15 ft	0.11 ft
1.17 cfs	0.15 ft	0.11 ft
1.18 cfs	0.15 ft	0.11 ft
1.19 cfs	0.15 ft	0.12 ft



Subcatchment #'s	Sumped Inlet #	Total Q (cfs)	Controlling Depth	Flow Spread		Road Cross
PF-5	PF-5	1.08	0.14	weir	3.75	2.00%
			0.10	orifice	1.62	2.00%

Job Name: **Parklands**
Job Number:
Date: 8/14/16 8:12 PM

Perk Filter PF-5
add 0.09 bypass from PF-6

Note: Include print of desgn info sheet

Low Point McMaster Dr.

Check 100-yr Flow

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - Assume 50% Clogged

From HEC-12 Eq. 17 (Weir condition)

$Q = CwPd^{1.5}$

Where:
Cw = 3.0
P = Perimeter of grate (Excluding sides against curbs)
d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)

$Q = CoA(2gd)^{0.5}$

Where:
Co = 0.67
A = Clear opening area of grate
g = 32.16 ft/s^2
d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Grate (Effective Length) Width (Curb)	Against Curb (Y/N)	Total Clear Opening	*Reduced Area	*Reduced Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.325 ft**	**3.50 ft**

*Note: 50% reduction

See Fig. 5-5 (Hydraulics Manual, 1997) 35% for vaned

Standard Inlet Specifications — Effective Dimensions

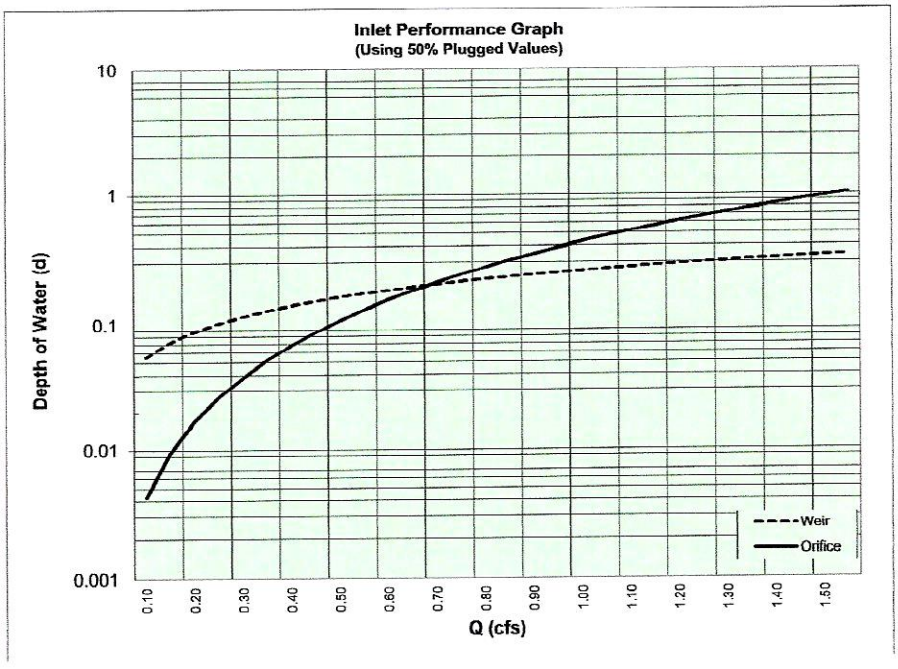
	Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.90 cfs
Table Increment: 0.01 cfs

CB#: PF-5 - 100-yr
Actual Q: 1.70 cfs
Depth weir: 0.23 ft

Depth orifice: 0.46 ft
Controlling Depth: 0.46 ft

Inlet Performance Table		
Q	d_{weir}	$d_{orifice}$
0.90 cfs	0.19 ft	0.27 ft
0.91 cfs	0.20 ft	0.27 ft
0.92 cfs	0.20 ft	0.28 ft
0.93 cfs	0.20 ft	0.28 ft
0.94 cfs	0.20 ft	0.29 ft
0.95 cfs	0.20 ft	0.30 ft
0.96 cfs	0.20 ft	0.30 ft
0.97 cfs	0.20 ft	0.31 ft
0.98 cfs	0.21 ft	0.31 ft
0.99 cfs	0.21 ft	0.32 ft
1.00 cfs	0.21 ft	0.33 ft
1.01 cfs	0.21 ft	0.33 ft
1.02 cfs	0.21 ft	0.34 ft
1.03 cfs	0.21 ft	0.35 ft
1.04 cfs	0.21 ft	0.35 ft
1.05 cfs	0.22 ft	0.36 ft
1.06 cfs	0.22 ft	0.37 ft
1.07 cfs	0.22 ft	0.38 ft
1.08 cfs	0.22 ft	0.38 ft
1.09 cfs	0.22 ft	0.39 ft
1.10 cfs	0.22 ft	0.40 ft
1.11 cfs	0.22 ft	0.40 ft
1.12 cfs	0.22 ft	0.41 ft
1.13 cfs	0.23 ft	0.42 ft
1.14 cfs	0.23 ft	0.43 ft
1.15 cfs	0.23 ft	0.43 ft
1.16 cfs	0.23 ft	0.44 ft
1.17 cfs	0.23 ft	0.45 ft
1.18 cfs	0.23 ft	0.46 ft
1.19 cfs	0.23 ft	0.46 ft



Subcatchment #'s	Sumped Inlet #'s	Total Q (cfs)	Controlling Depth		Flow Spread	Road Cross
PF-5	PF-5	1.70	0.23	weir	8.54	2.00%
			0.46	orifice	20.05	2.00%
Find flow for 14 ft spread condition (see 0.28 in chart)		1.02	0.34	orifice	14.00	2.00%

Note: Overflow to Inlet PF-3 and PF-4 (also low point inlets) would occur at 14 ft spread.
So overflow would be 1.70 cfs - 1.02 cfs = 0.68 cfs and PF-3 100-yr flow is only 0.40 cfs and PF-4, 100-yr flow is only 0.57 cfs*
PF-4 does have some bypass flow from PF-7, as well.

These two low point inlets have the same 1.02 cfs capacity as PF-5, or a total of 2.04 cfs
(0.40 + 0.57+0.09 bypass from PF-7)+ overflow from PF-5 = 1.74 cfs Less than 2.04 cfs, so OK.
Conservative, as this evaluation represents worst case with all three inlets at 50% clogged.

Job Name: **Parklands** Note: Include print of desgn info sheet

Job Number:

Date: 8/14/16 4:07 PM

Perk Filter PF-15

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)
$Q = CwPd^{1.5}$
Where:
Cw = 3.0
P = Perimeter of grate (Excluding sides against curbs)
d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)
$Q = CoA(2gd)^{0.5}$
Where:
Co = 0.67
A = Clear opening area of grate
g = 32.16 ft/s^2
d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

See Fig. 5-5 (Hydraulics Manual, 1997) 35% for vaned

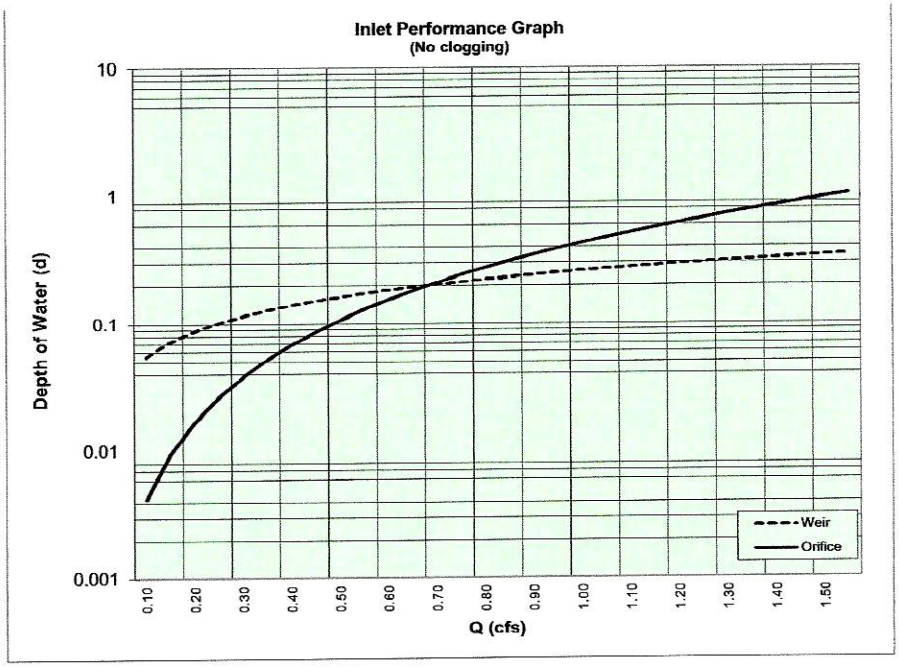
Standard Inlet Specifications	Effective Dimensions Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.50 cfs
Table Increment: 0.01 cfs

CB#: PF-15 - 10yr
Actual Q: 0.54 cfs
Depth weir: 0.09 ft

Depth orifice: 0.02 ft
Controlling Depth: 0.09 ft

Inlet Performance Table		
Q	d_{weir}	$d_{orifice}$
0.50 cfs	0.08 ft	0.02 ft
0.51 cfs	0.08 ft	0.02 ft
0.52 cfs	0.08 ft	0.02 ft
0.53 cfs	0.09 ft	0.02 ft
0.54 cfs	0.09 ft	0.02 ft
0.55 cfs	0.09 ft	0.02 ft
0.56 cfs	0.09 ft	0.03 ft
0.57 cfs	0.09 ft	0.03 ft
0.58 cfs	0.09 ft	0.03 ft
0.59 cfs	0.09 ft	0.03 ft
0.60 cfs	0.09 ft	0.03 ft
0.61 cfs	0.09 ft	0.03 ft
0.62 cfs	0.10 ft	0.03 ft
0.63 cfs	0.10 ft	0.03 ft
0.64 cfs	0.10 ft	0.03 ft
0.65 cfs	0.10 ft	0.03 ft
0.66 cfs	0.10 ft	0.04 ft
0.67 cfs	0.10 ft	0.04 ft
0.68 cfs	0.10 ft	0.04 ft
0.69 cfs	0.10 ft	0.04 ft
0.70 cfs	0.10 ft	0.04 ft
0.71 cfs	0.10 ft	0.04 ft
0.72 cfs	0.11 ft	0.04 ft
0.73 cfs	0.11 ft	0.04 ft
0.74 cfs	0.11 ft	0.04 ft
0.75 cfs	0.11 ft	0.05 ft
0.76 cfs	0.11 ft	0.05 ft
0.77 cfs	0.11 ft	0.05 ft
0.78 cfs	0.11 ft	0.05 ft
0.79 cfs	0.11 ft	0.05 ft



Subcatchment #'s	Sumped Inlet #	Total Q (cfs)	Controlling Depth		Flow Spread	Road Cross
PF-15	PF-15	0.54	0.09	weir	1.19	2.00%
			0.02	orifice	within gutter	2.00%

Job Name: **Parklands** Note: Include print of desgn info sheet

Job Number:

Date: 9/7/16 10:06 AM

Perk Filter PF-18,19, 20, & PF-21

KEY
Design Values
Results

Grated Inlet Capacity in a Sump Condition - No Clogging

From HEC-12 Eq. 17 (Weir condition)

$Q = CwPd^{1.5}$

Where:

Cw = 3.0

P = Perimeter of grate (Excluding sides against curbs)

d = Depth of flow

From HEC-12 Eq. 18 (Orifice condition)

$Q = CoA(2gd)^{0.5}$

Where:

Co = 0.67

A = Clear opening area of grate

g = 32.16 ft/s^2

d = Depth of flow

Inlet Description	Grate (Effective Length) Length	Width (Curb)	Against Curb (Y/N)	Total Clear Opening	Effective Area	Effective Perimeter
PERK FILTER 24" x 24"	1.75 ft	1.75 ft	Y	0.65 sf	**0.650 ft**	**7.00 ft**

See Fig. 5-5 (Hydraulics Manual, 1997) 35% for vaned

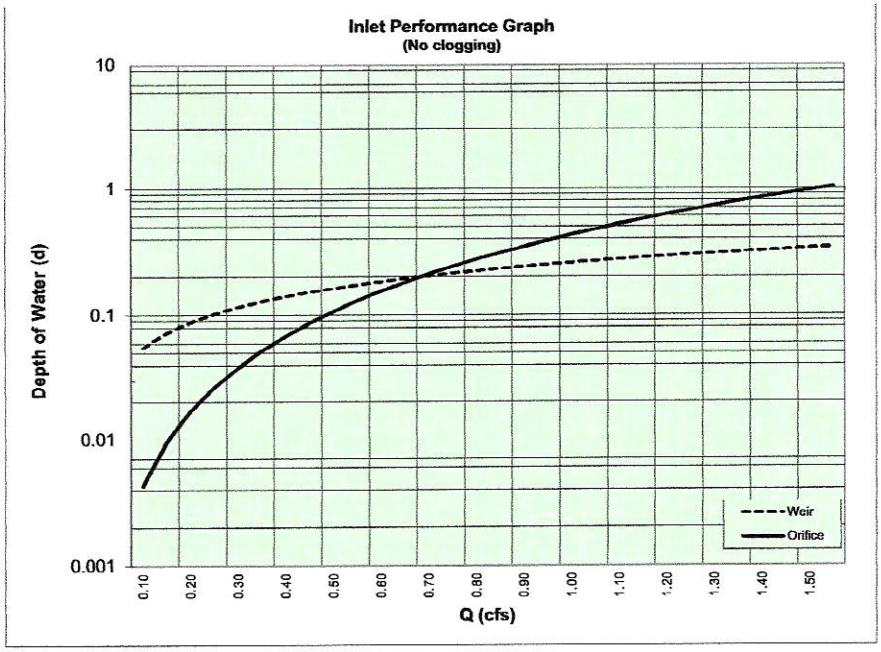
Standard Inlet Specifications	Effective Dimensions Grate Length	Grate Width	Open Area
WSDOT B-30.10 (Herringbone)	1.50 ft	1.71 ft	0.54 sf
WSDOT B-30.30 or 30.40 (Vaned)	1.25 ft	1.31 ft	0.57 sf
WSDOT 30.30 (Grate Inlet Type 1) A	3.85 ft	2.00 ft	5.88 sf
WSDOT 30.30 (Grate Inlet Type 1) B	3.85 ft	2.00 ft	5.88 sf

Table Initial Q: 0.30 cfs
Table Increment: 0.01 cfs

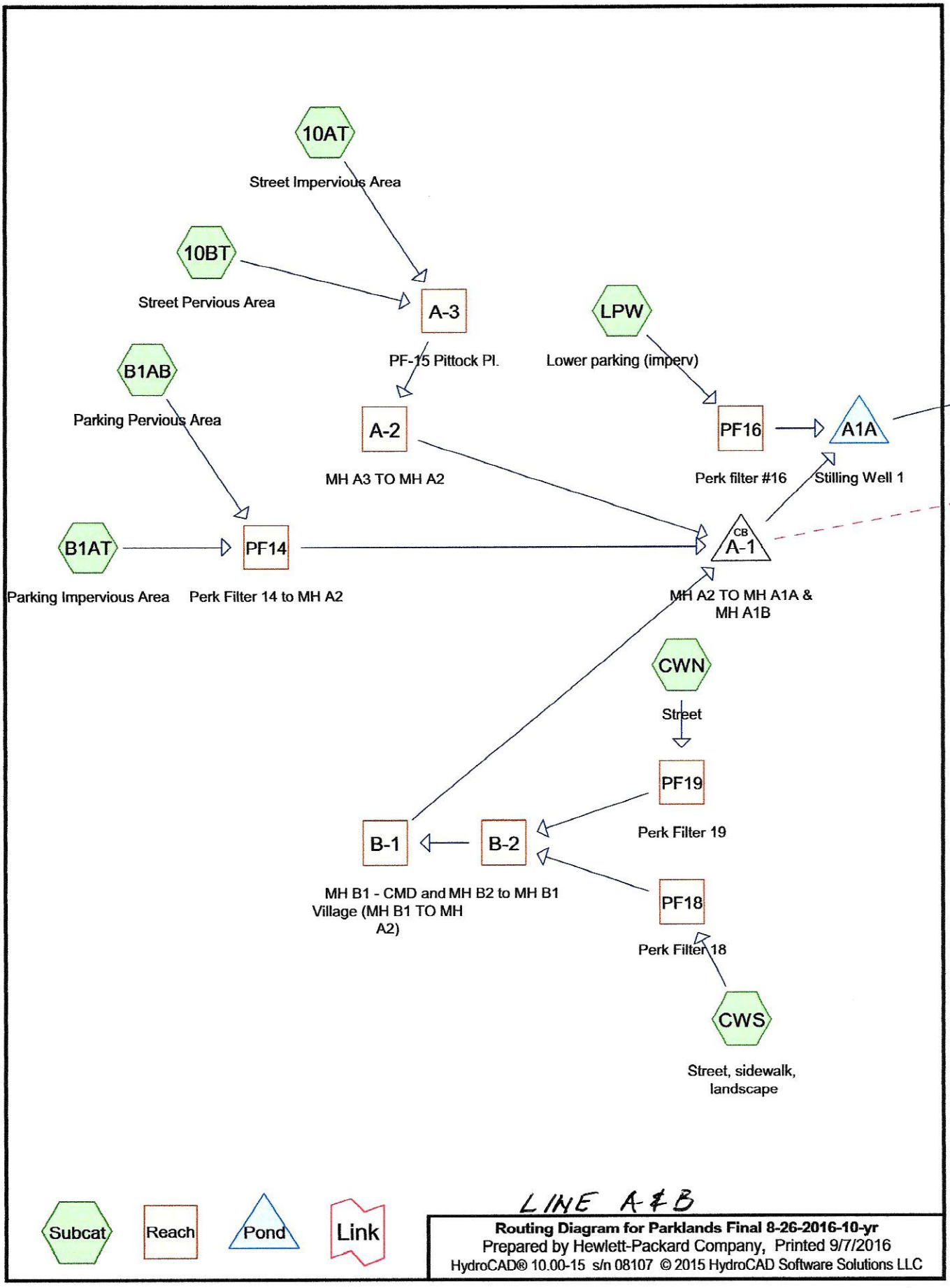
PF-18 = 0.50
PF-19 = 0.39
PF-20 = 0.43
PF-21 = 0.48
CB#: PF-2- 10yr
Actual Q: 0.50 cfs
Depth weir: 0.08 ft

Depth orifice: 0.02 ft
Controlling Depth: 0.08 ft

Inlet Performance Table		
Q	d_{weir}	$d_{orifice}$
0.30 cfs	0.06 ft	0.01 ft
0.31 cfs	0.06 ft	0.01 ft
0.32 cfs	0.06 ft	0.01 ft
0.33 cfs	0.06 ft	0.01 ft
0.34 cfs	0.06 ft	0.01 ft
0.35 cfs	0.07 ft	0.01 ft
0.36 cfs	0.07 ft	0.01 ft
0.37 cfs	0.07 ft	0.01 ft
0.38 cfs	0.07 ft	0.01 ft
0.39 cfs	0.07 ft	0.01 ft
0.40 cfs	0.07 ft	0.01 ft
0.41 cfs	0.07 ft	0.01 ft
0.42 cfs	0.07 ft	0.01 ft
0.43 cfs	0.07 ft	0.02 ft
0.44 cfs	0.08 ft	0.02 ft
0.45 cfs	0.08 ft	0.02 ft
0.46 cfs	0.08 ft	0.02 ft
0.47 cfs	0.08 ft	0.02 ft
0.48 cfs	0.08 ft	0.02 ft
0.49 cfs	0.08 ft	0.02 ft
0.50 cfs	0.08 ft	0.02 ft
0.51 cfs	0.08 ft	0.02 ft
0.52 cfs	0.08 ft	0.02 ft
0.53 cfs	0.09 ft	0.02 ft
0.54 cfs	0.09 ft	0.02 ft
0.55 cfs	0.09 ft	0.02 ft
0.56 cfs	0.09 ft	0.03 ft
0.57 cfs	0.09 ft	0.03 ft
0.58 cfs	0.09 ft	0.03 ft
0.59 cfs	0.09 ft	0.03 ft



Subcatchment #'s	Sumped Inlet #'s	Total Q (cfs)	Controlling Depth		Flow Spread	Road Cross
CWS	PF-18	0.50	0.08	weir	within gutter	2.00%
			0.02	orifice	within gutter	2.00%
CWN	PF-19	0.39	0.07	weir	within gutter	2.00%
			0.01	orifice	within gutter	2.00%
CES	PF-20	0.43	0.07	weir	within gutter	2.00%
			0.01	orifice	within gutter	2.00%
CEN	PF-21	0.48	0.08	weir	within gutter	2.00%
			0.02	orifice	within gutter	2.00%


10AT
Street Impervious Area
10BT
Street Pervious Area
A-3
PF-15 Pittock Pl.
LPW
Lower parking (imperv)
B1AB
Parking Pervious Area
A-2
MH A3 TO MH A2
PF16
Perk filter #16
A1A
Stilling Well 1
B1AT
Parking Impervious Area
PF14
Perk Filter 14 to MH A2
CB
A-1
MH A2 TO MH A1A & MH A1B
CWN
Street
PF19
Perk Filter 19
B-1
B-2
MH B1 - CMD and MH B2 to MH B1 Village (MH B1 TO MH A2)
PF18
Perk Filter 18
CWS
Street, sidewalk, landscape
Subcat
Reach
Pond
Link
LINE A & B
Routing Diagram for Parklands Final 8-26-2016-10-yr
Prepared by Hewlett-Packard Company, Printed 9/7/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

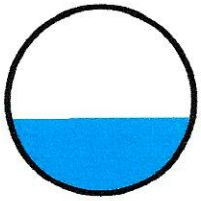
Summary for Reach A-3: PF-15 Pittock Pl.

Inflow Area = 0.687 ac, 66.25% Impervious, Inflow Depth = 3.16" for 10-yr event
Inflow = 0.54 cfs @ 7.90 hrs, Volume= 0.181 af
Outflow = 0.54 cfs @ 7.91 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.58 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 1.2 min

Peak Storage= 22 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 1.54 cfs

10.0" Round Pipe
n= 0.013
Length= 107.0' Slope= 0.0050 '/'
Inlet Invert= 201.36', Outlet Invert= 200.83'



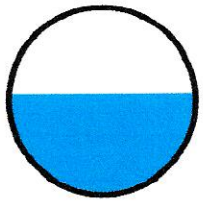
Summary for Reach PF14: Perk Filter 14 to MH A2

Inflow Area = 0.829 ac, 85.71% Impervious, Inflow Depth = 3.34" for 10-yr event
Inflow = 0.68 cfs @ 7.90 hrs, Volume= 0.230 af
Outflow = 0.68 cfs @ 7.90 hrs, Volume= 0.230 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 3.57 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.05 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.21 cfs

8.0" Round Pipe
n= 0.013
Length= 8.0' Slope= 0.0100 '/'
Inlet Invert= 212.80', Outlet Invert= 212.72'



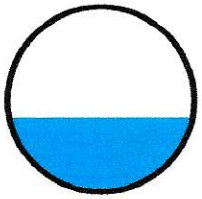
Summary for Reach PF16: Perk filter #16

Inflow Area = 0.484 ac, 93.53% Impervious, Inflow Depth = 3.47" for 10-yr event
Inflow = 0.42 cfs @ 7.89 hrs, Volume= 0.140 af
Outflow = 0.42 cfs @ 7.89 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 3.15 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.79 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 7.89 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.21 cfs

8.0" Round Pipe
n= 0.013
Length= 8.0' Slope= 0.0100 '/'
Inlet Invert= 296.17', Outlet Invert= 296.09'



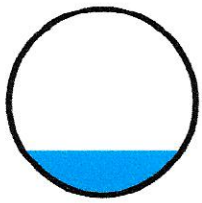
Summary for Reach PF18: Perk Filter 18

Inflow Area = 0.692 ac, 73.27% Impervious, Inflow Depth = 3.14" for 10-yr event
Inflow = 0.50 cfs @ 7.98 hrs, Volume= 0.181 af
Outflow = 0.50 cfs @ 7.98 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 4.92 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.77 fps, Avg. Travel Time= 0.2 min

Peak Storage= 3 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 3.90 cfs

10.0" Round Pipe
n= 0.013
Length= 30.0' Slope= 0.0317 '/'
Inlet Invert= 216.64', Outlet Invert= 215.69'



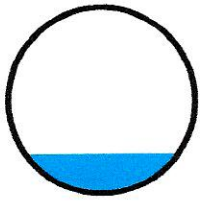
Summary for Reach PF19: Perk Filter 19

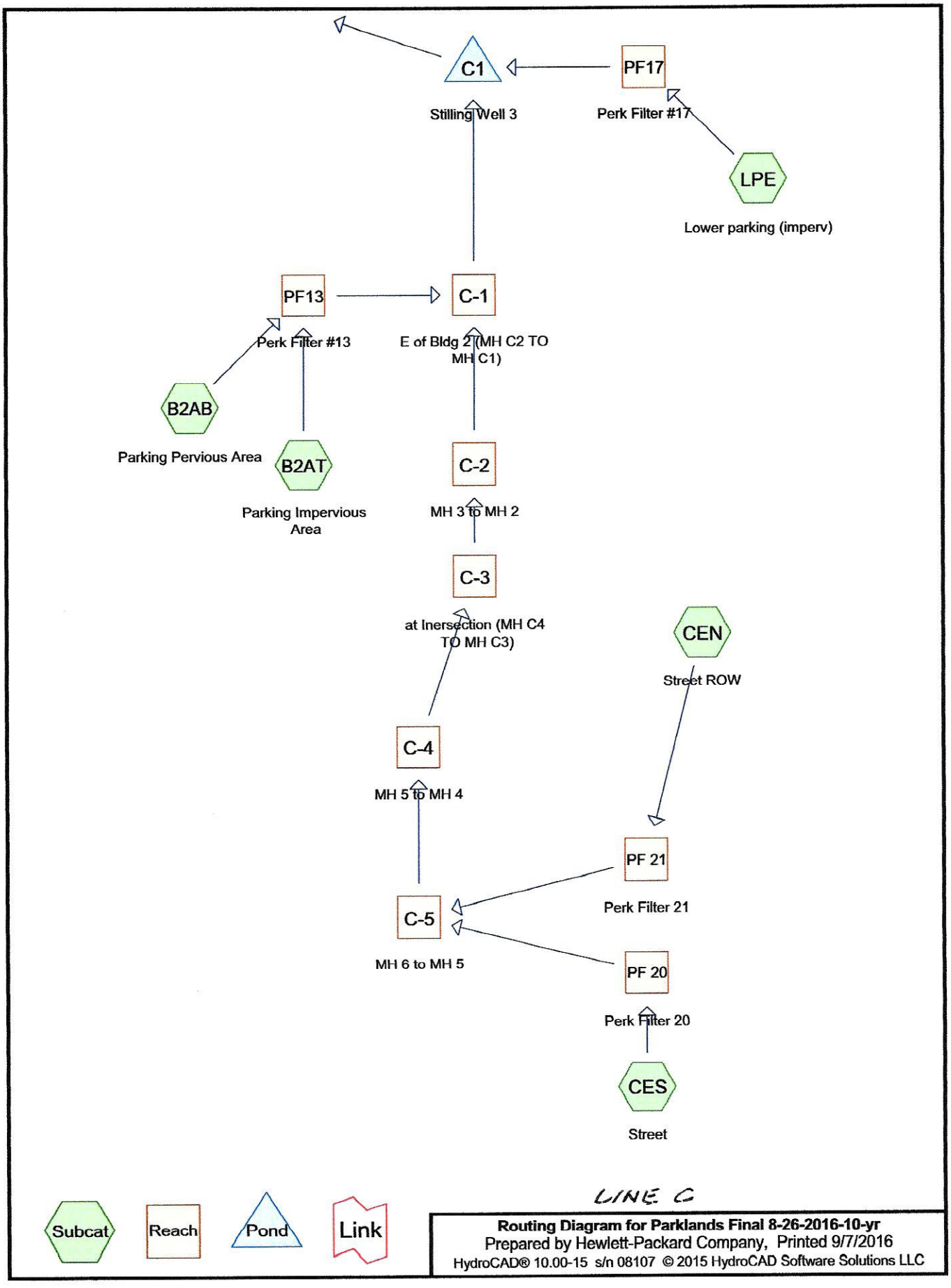
Inflow Area = 0.511 ac, 82.63% Impervious, Inflow Depth = 3.29" for 10-yr event
Inflow = 0.39 cfs @ 7.98 hrs, Volume= 0.140 af
Outflow = 0.39 cfs @ 7.98 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 4.57 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.57 fps, Avg. Travel Time= 0.2 min

Peak Storage= 3 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 3.90 cfs

10.0" Round Pipe
n= 0.013
Length= 30.0' Slope= 0.0317 '/'
Inlet Invert= 216.64', Outlet Invert= 215.69'




C1
Stilling Well 3
PF17
Perk Filter #17
LPE
Lower parking (imperv)
PF13
Perk Filter #13
C-1
E of Bldg 2 (MH C2 TO MH C1)
B2AB
Parking Pervious Area
B2AT
Parking Impervious Area
C-2
MH 3 to MH 2
C-3
at Inersection (MH C4 TO MH C3)
CEN
Street ROW
C-4
MH 5 to MH 4
PF 21
Perk Filter 21
C-5
MH 6 to MH 5
PF 20
Perk Filter 20
CES
Street
Subcat
Reach
Pond
Link
LINE C
Routing Diagram for Parklands Final 8-26-2016-10-yr
Prepared by Hewlett-Packard Company, Printed 9/7/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

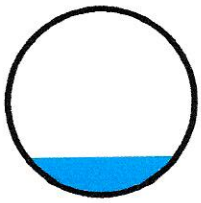
Summary for Reach PF 20: Perk Filter 20

Inflow Area = 0.598 ac, 72.87% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 0.43 cfs @ 7.98 hrs, Volume= 0.155 af
Outflow = 0.43 cfs @ 7.98 hrs, Volume= 0.155 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 5.53 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.11 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 4.90 cfs

10.0" Round Pipe
n= 0.013
Length= 23.6' Slope= 0.0500 '/'
Inlet Invert= 225.19', Outlet Invert= 224.01'



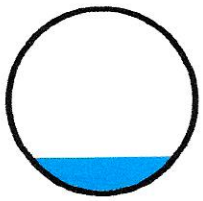
Summary for Reach PF 21: Perk Filter 21

Inflow Area = 0.633 ac, 81.52% Impervious, Inflow Depth = 3.25" for 10-yr event
Inflow = 0.48 cfs @ 7.98 hrs, Volume= 0.172 af
Outflow = 0.48 cfs @ 7.98 hrs, Volume= 0.172 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 6.87 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.86 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 6.37 cfs

10.0" Round Pipe
n= 0.013
Length= 24.0' Slope= 0.0846 '/'
Inlet Invert= 226.02', Outlet Invert= 223.99'



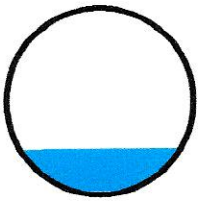
Summary for Reach PF13: Perk Filter #13

Inflow Area = 0.601 ac, 83.31% Impervious, Inflow Depth = 3.30" for 10-yr event
Inflow = 0.49 cfs @ 7.90 hrs, Volume= 0.165 af
Outflow = 0.49 cfs @ 7.90 hrs, Volume= 0.165 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 7.25 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.06 fps, Avg. Travel Time= 0.3 min

Peak Storage= 4 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 3.63 cfs

8.0" Round Pipe
n= 0.013
Length= 65.0' Slope= 0.0903 '/'
Inlet Invert= 211.87', Outlet Invert= 206.00'



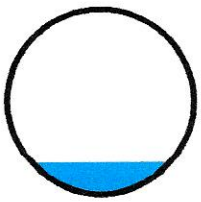
Summary for Reach PF17: Perk Filter #17

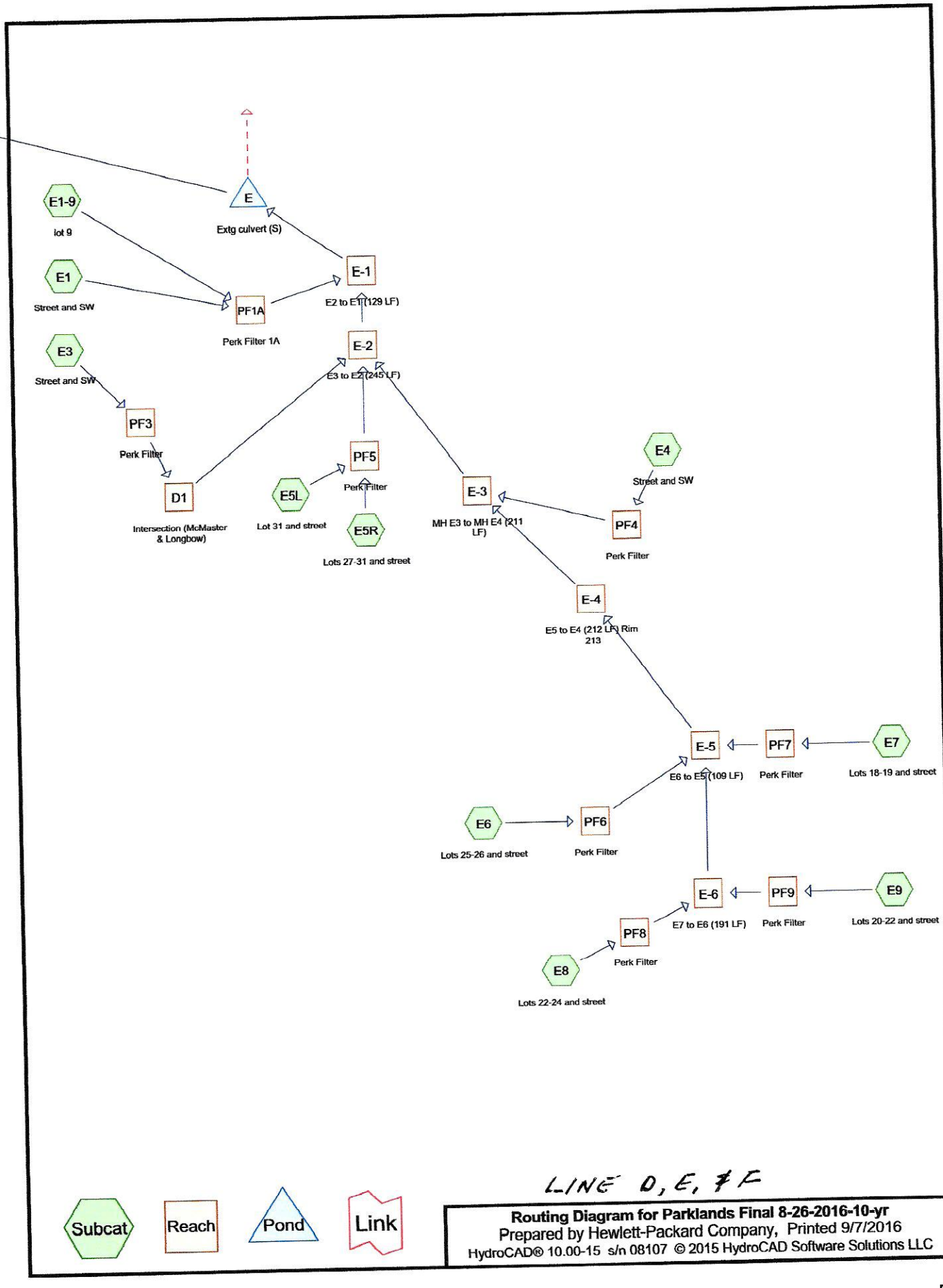
Inflow Area = 0.540 ac, 96.88% Impervious, Inflow Depth = 3.52" for 10-yr event
Inflow = 0.47 cfs @ 7.89 hrs, Volume= 0.158 af
Outflow = 0.47 cfs @ 7.89 hrs, Volume= 0.158 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 12.88 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 7.20 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 7.89 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 8.28 cfs

8.0" Round Pipe
n= 0.013
Length= 20.0' Slope= 0.4690 '/'
Inlet Invert= 199.05', Outlet Invert= 189.67'




E
Extg culvert (S)
E1-9
lot 9
E1
Street and SW
PF1A
Perk Filter 1A
E-1
E2 to E1 (129 LF)
E-2
E3 to E2 (245 LF)
E3
Street and SW
PF3
Perk Filter
D1
Intersection (McMaster & Longbow)
PF5
Perk Filter
E5L
Lot 31 and street
E5R
Lots 27-31 and street
E-3
MH E3 to MH E4 (211 LF)
E4
Street and SW
PF4
Perk Filter
E-4
E5 to E4 (212 LF) Rim 213
E-5
E6 to E5 (109 LF)
PF7
Perk Filter
E7
Lots 18-19 and street
E6
Lots 25-26 and street
PF6
Perk Filter
E-6
E7 to E6 (191 LF)
PF9
Perk Filter
E9
Lots 20-22 and street
PF8
Perk Filter
E8
Lots 22-24 and street
Subcat
Reach
Pond
Link
LINE D, E, & F
Routing Diagram for Parklands Final 8-26-2016-10-yr
Prepared by Hewlett-Packard Company, Printed 9/7/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

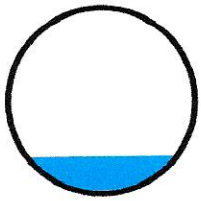
Summary for Reach PF1A: Perk Filter 1A

Inflow Area = 0.344 ac, 45.85% Impervious, Inflow Depth = 2.77" for 10-yr event
Inflow = 0.23 cfs @ 7.96 hrs, Volume= 0.079 af
Outflow = 0.23 cfs @ 7.96 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 4.36 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.44 fps, Avg. Travel Time= 0.2 min

Peak Storage= 1 cf @ 7.96 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 2.43 cfs

8.0" Round Pipe
n= 0.013
Length= 26.0' Slope= 0.0404 '/'
Inlet Invert= 188.52', Outlet Invert= 187.47'



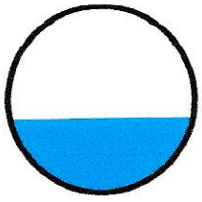
Summary for Reach PF3: Perk Filter

Inflow Area = 0.336 ac, 87.33% Impervious, Inflow Depth = 3.35" for 10-yr event
Inflow = 0.28 cfs @ 7.89 hrs, Volume= 0.094 af
Outflow = 0.28 cfs @ 7.89 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.14 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 0.2 min

Peak Storage= 2 cf @ 7.89 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.83 cfs

8.0" Round Pipe
n= 0.013
Length= 15.0' Slope= 0.0047 '/'
Inlet Invert= 199.47', Outlet Invert= 199.40'



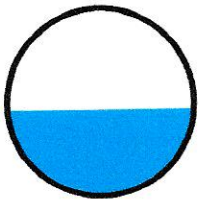
Summary for Reach PF4: Perk Filter

Inflow Area = 0.541 ac, 58.09% Impervious, Inflow Depth = 2.86" for 10-yr event
Inflow = 0.38 cfs @ 7.91 hrs, Volume= 0.129 af
Outflow = 0.38 cfs @ 7.91 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.37 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.85 cfs

8.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0050 '/'
Inlet Invert= 198.38', Outlet Invert= 198.33'



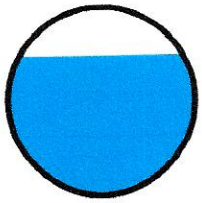
Summary for Reach PF5: Perk Filter

Inflow Area = 1.727 ac, 35.49% Impervious, Inflow Depth = 2.76" for 10-yr event
Inflow = 1.05 cfs @ 8.00 hrs, Volume= 0.398 af
Outflow = 1.05 cfs @ 8.00 hrs, Volume= 0.398 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 3.77 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.24 fps, Avg. Travel Time= 0.1 min

Peak Storage= 4 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.16 cfs

8.0" Round Pipe
n= 0.013
Length= 13.0' Slope= 0.0092 '/'
Inlet Invert= 198.41', Outlet Invert= 198.29'



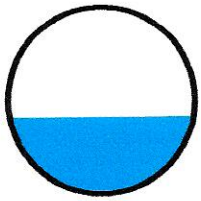
Summary for Reach PF6: Perk Filter

Inflow Area = 0.509 ac, 28.21% Impervious, Inflow Depth = 2.69" for 10-yr event
Inflow = 0.30 cfs @ 8.00 hrs, Volume= 0.114 af
Outflow = 0.30 cfs @ 8.00 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.24 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 0.2 min

Peak Storage= 2 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.85 cfs

8.0" Round Pipe
n= 0.013
Length= 12.0' Slope= 0.0050 '/'
Inlet Invert= 210.21', Outlet Invert= 210.15'



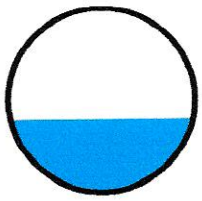
Summary for Reach PF7: Perk Filter

Inflow Area = 0.508 ac, 28.29% Impervious, Inflow Depth = 2.69" for 10-yr event
Inflow = 0.30 cfs @ 8.00 hrs, Volume= 0.114 af
Outflow = 0.30 cfs @ 8.00 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.39 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.94 cfs

8.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0060 '/'
Inlet Invert= 210.21', Outlet Invert= 210.15'



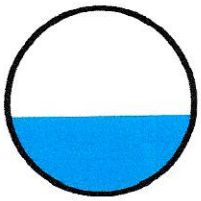
Summary for Reach PF8: Perk Filter

Inflow Area = 0.560 ac, 22.57% Impervious, Inflow Depth = 2.63" for 10-yr event
Inflow = 0.32 cfs @ 8.00 hrs, Volume= 0.123 af
Outflow = 0.32 cfs @ 8.00 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.28 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 0.2 min

Peak Storage= 2 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.85 cfs

8.0" Round Pipe
n= 0.013
Length= 12.0' Slope= 0.0050 '/'
Inlet Invert= 212.21', Outlet Invert= 212.15'



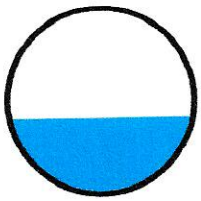
Summary for Reach PF9: Perk Filter

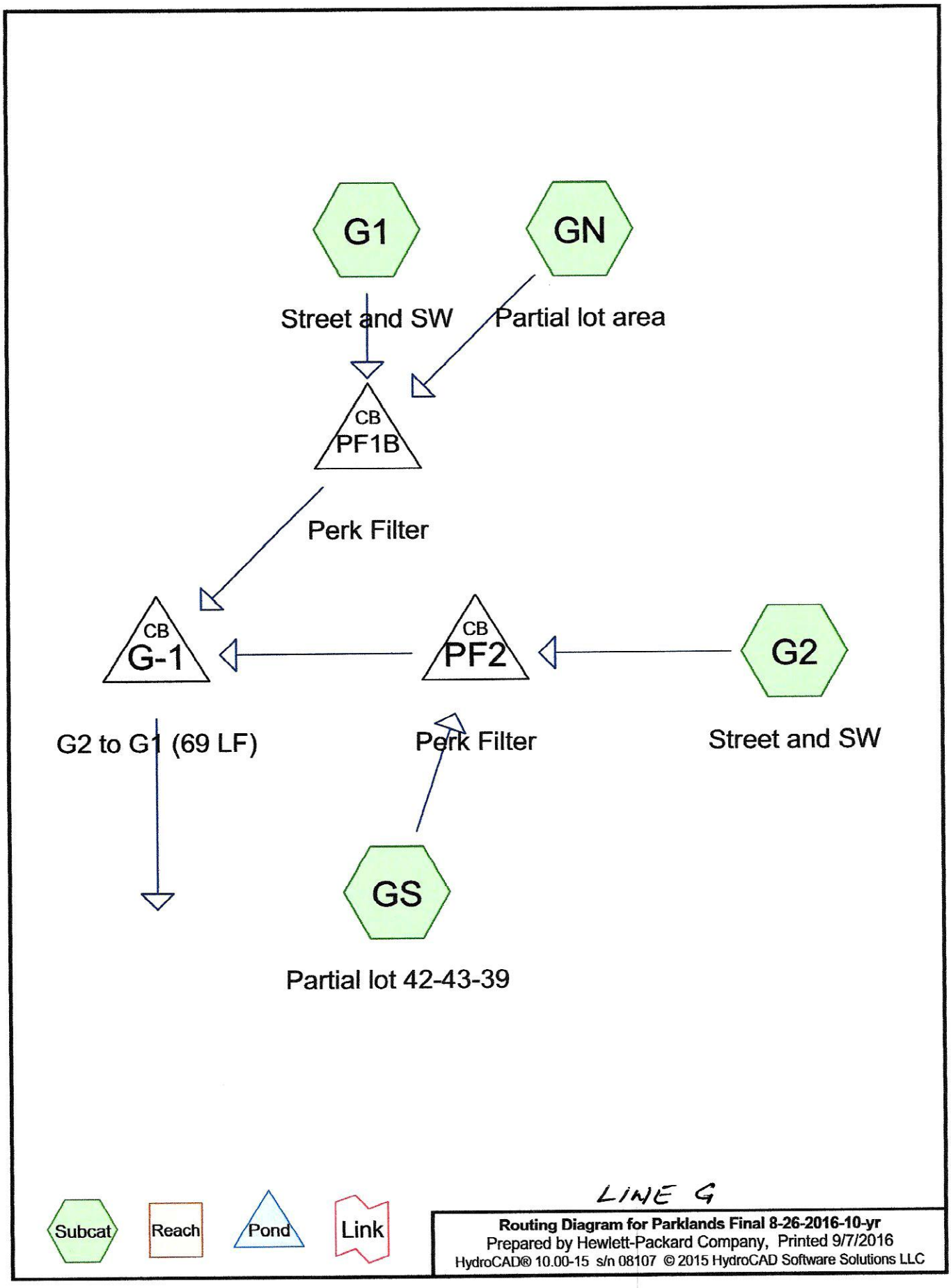
Inflow Area = 0.560 ac, 22.57% Impervious, Inflow Depth = 2.63" for 10-yr event
Inflow = 0.32 cfs @ 8.00 hrs, Volume= 0.123 af
Outflow = 0.32 cfs @ 8.00 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.44 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.94 cfs

8.0" Round Pipe
n= 0.013
Length= 10.0' Slope= 0.0060 '/'
Inlet Invert= 212.21', Outlet Invert= 212.15'




G1
GN
Street and SW
Partial lot area
CB
PF1B
Perk Filter
CB
G-1
CB
PF2
G2
G2 to G1 (69 LF)
Perk Filter
Street and SW
GS
Partial lot 42-43-39
Subcat
Reach
Pond
Link
LINE G
Routing Diagram for Parklands Final 8-26-2016-10-yr
Prepared by Hewlett-Packard Company, Printed 9/7/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

Summary for Pond PF1B: Perk Filter

Inflow Area = 0.932 ac, 55.10% Impervious, Inflow Depth = 2.89" for 10-yr event
Inflow = 0.64 cfs @ 7.95 hrs, Volume= 0.225 af
Outflow = 0.64 cfs @ 7.95 hrs, Volume= 0.225 af, Atten= 0%, Lag= 0.0 min
Primary = 0.64 cfs @ 7.95 hrs, Volume= 0.225 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 188.65' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	186.50'	**6.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 186.50' / 186.43' S= 0.0064 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.63 cfs @ 7.95 hrs HW=188.63' TW=188.19' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.63 cfs @ 3.19 fps)

Summary for Pond PF2: Perk Filter

Inflow Area = 0.736 ac, 53.88% Impervious, Inflow Depth = 2.89" for 10-yr event
Inflow = 0.51 cfs @ 7.95 hrs, Volume= 0.177 af
Outflow = 0.51 cfs @ 7.95 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min
Primary = 0.51 cfs @ 7.95 hrs, Volume= 0.177 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 188.48' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	186.41'	**6.0" Round Culvert** L= 13.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 186.41' / 186.36' S= 0.0038 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.48 cfs @ 7.95 hrs HW=188.45' TW=188.19' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.48 cfs @ 2.47 fps)

APPENDIX E-2 CATCH BASIN DESIGN COMMENTS

8.2 Catch Basin Locations

Catch basins and inlets are required at the following locations:

1. At any low point in the roadway or curb returns at intersections.

   - **This criteria has been met.**

2. Where any roadway transitions from a crown section to a shed section to prevent gutter flow from flowing across the roadway.

   - **N/A**

3. Such that a maximum of 400 linear feet of paved street is collected by a single catch basin.

   - **Inlet calcs. provided**

4. Inlets shall be used at intersections to prevent street cross-flow, which could cause pedestrian or vehicular hazards. It is desirable to intercept 100 percent of any potential street cross-flow under these conditions. Intersection inlets should be placed on tangent curb sections near corners. Catch basins and inlets shall be placed so that water will not accumulate on walking surfaces per ADA guidelines.

   - **This criteria has been met**

5. In sag vertical curves, where significant ponding may occur, flanking inlets shall be placed to limit spread on low gradient approaches to the level point. The flanking inlets are intended to provide relief if the inlet at the low point becomes clogged or if the design spread is exceeded.

   - **Flanking inlets are not proposed. Inlet calcs. with 50% assumed clogging have been made for the 100-yr event.**

6. Combination inlets or curb opening inlets shall be used in sag locations. Grate inlets are not allowed because of their tendency to become clogged.

   - **Combination inlets are not proposed. The inlets are part of the Perk Filter units and are 24” x 24” grates.**

7. Combination curb inlets are required on slopes greater than 10 percent or when necessary to prevent bypass flow from crossing an ADA ramp. Curb ramps and their approaches shall be designed so that water will not accumulate on walking surfaces per ADA guidelines.

   - **Calculations to determine bypass have been provided and accounted for at downslope structures.**

APPENDIX E-2 CATCH BASIN DESIGN COMMENTS

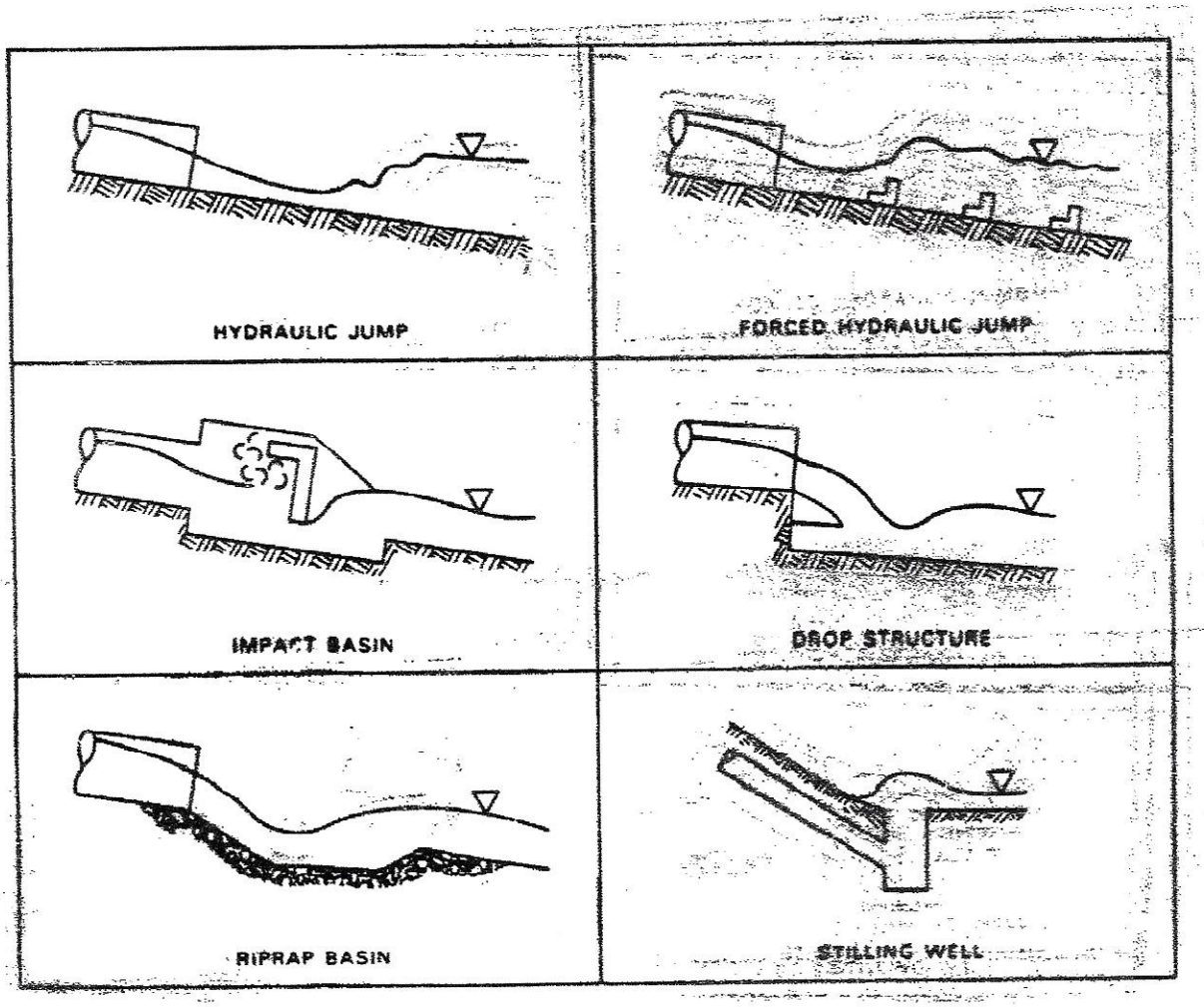
Hydraulic Design of Energy Dissipators for Culverts and Channels

Hydraulic Engineering Circular No. 14

September 1983

U.S. Department of Transportation

Federal Highway Administration



X-B. CORPS OF ENGINEERS STILLING WELL

The design of this type of stilling well energy dissipator is based on model tests conducted by the Corps of Engineers. (X-B-1 and 2)

The dissipator has application where debris is not a serious problem. It will operate with moderate to high concentrations of sand and silt but is not recommended for areas where quantities of large floating or rolling debris is expected unless suitable debris-control structures are utilized. Its greatest potential, as far as highways are concerned, is at the outfalls of storm drains, median, and pipe down drains where little debris is expected. It may also be useful as a temporary erosion control device during construction.

Design Recommendations

The design is straightforward. Once the size and discharge of the incoming pipe are determined, figure X-B-1 is used to select the stilling well diameter (D_W). The model tests indicated that satisfactory performance can be maintained for $Q/D^{5/2}$ ratios as large as 10.0, with stilling well diameters of one, two, three, and five times that of the incoming conduits. These ratios were used to define the curves shown in figure X-B-1.

The tests also indicated that there is an optimum depth of stilling well below the invert of the incoming pipe. This depth is determined by entering figure X-B-2 with the slope of the incoming pipe and using the stilling well diameter (D_W) previously obtained from figure X-B-1.

The height of the stilling well above the invert is fixed at twice the diameter of the incoming pipe (2D). This dimension results in satisfactory operation and is practical from a cost standpoint; however, if increased, greater efficiency will result.

Tailwater also increases the efficiency of the stilling well. Whenever possible, it should be located in a sump or depressed area.

It is recommended that riprap or other types of channel protection be provided around the stilling well outlet and for a distance of at least $3D_W$ downstream.

The outlet may also be covered with a screen or grate for safety. However, the screen or grate should have a clear opening area of at least 75 percent of the total stilling well area and be capable of passing small floating debris such as cans and bottles.

Design Procedures

(1) Select approach pipe diameter (D) and discharge (Q).

(2) Obtain well diameter (D_W) from figure X-B-1.

(3) Calculate the culvert slope = (Vertical/horizontal distance). The depth of the well below the culvert invert (h_1) is determined from figure X-B-2.

(4) The depth of the well above the culvert invert (h_2) is equal to 2(D) as a minimum but may be greater if the site permits.

(5) The total height of the well (h_W) = h_1+h_2.

Example Problem

Given: 24" CMP downdrain on a 2:1 slope carrying a Q = 15 cfs

Find: Stilling well dimensions

Solution:

(1) D=2 ft., Q=15 cfs
(2) From figure X-B-1 $D_W=1.5D=3$ ft.
(3) Slope=1/2=.5, $h_1/D_W=.42$ from figure X-B-2
$h_1=.42(3.0)=1.26$ ft., Use $h_1=1.3$ ft.
(4) $h_2=2(D)=2(2)=4$ ft.
(5) $h_W= h_1+h_2=1.3+4=5.3$ ft.

X-B-1. IMPACT-TYPE ENERGY DISSIPATOR FOR STORM-DRAINAGE OUTFALLS STILLING WELL DESIGN, U. S. Army Corps of Engineers, Technical Report No. 2-620 March 1963, WES, Vicksburg, Mississippi.

X-B-2. Grace, J. L., Pickering, G. A., EVALUATION OF THREE ENERGY DISSIPATORS FOR STORM DRAIN OUTLETS, U.S. Army WES, HRB 1971, Washington, D.C.

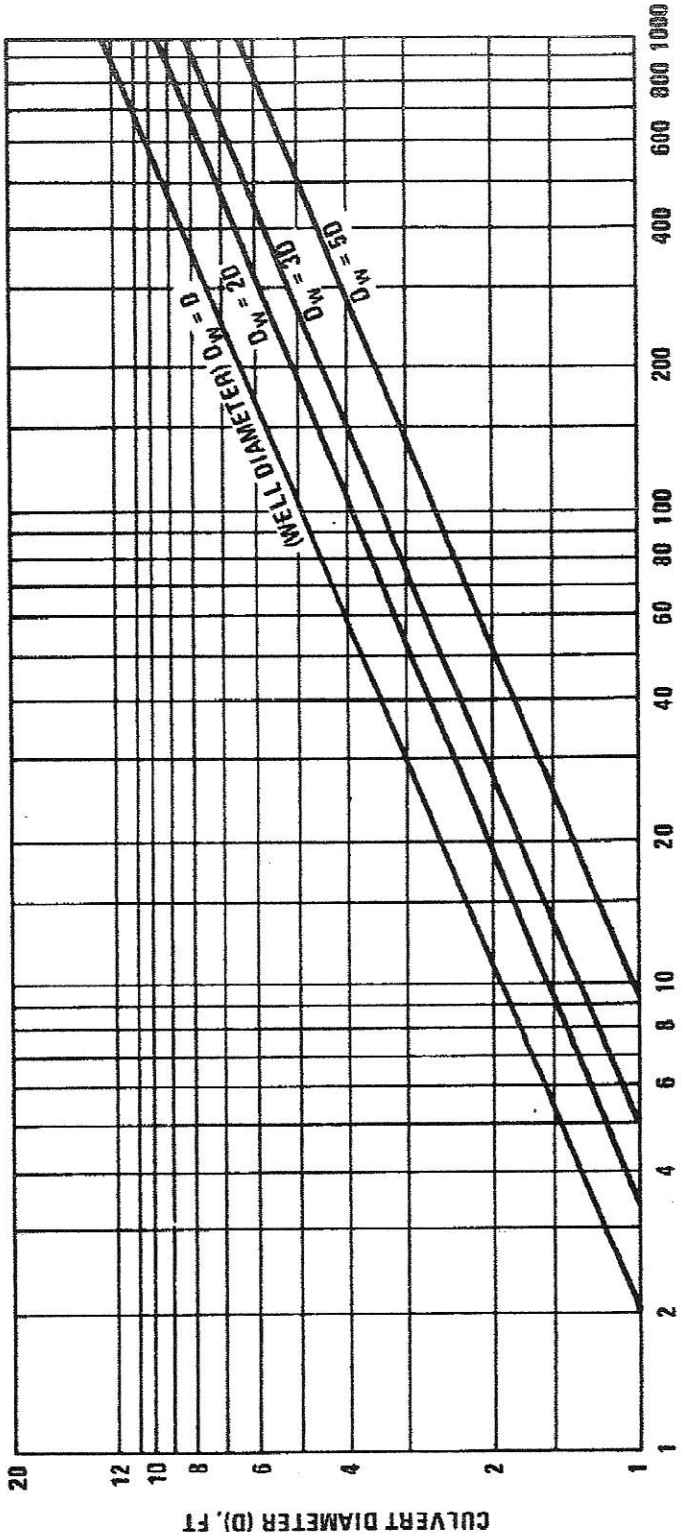


FIGURE X-B-1. STILLING WELL DIAMETER (D_W) FROM REFERENCE X-B-1

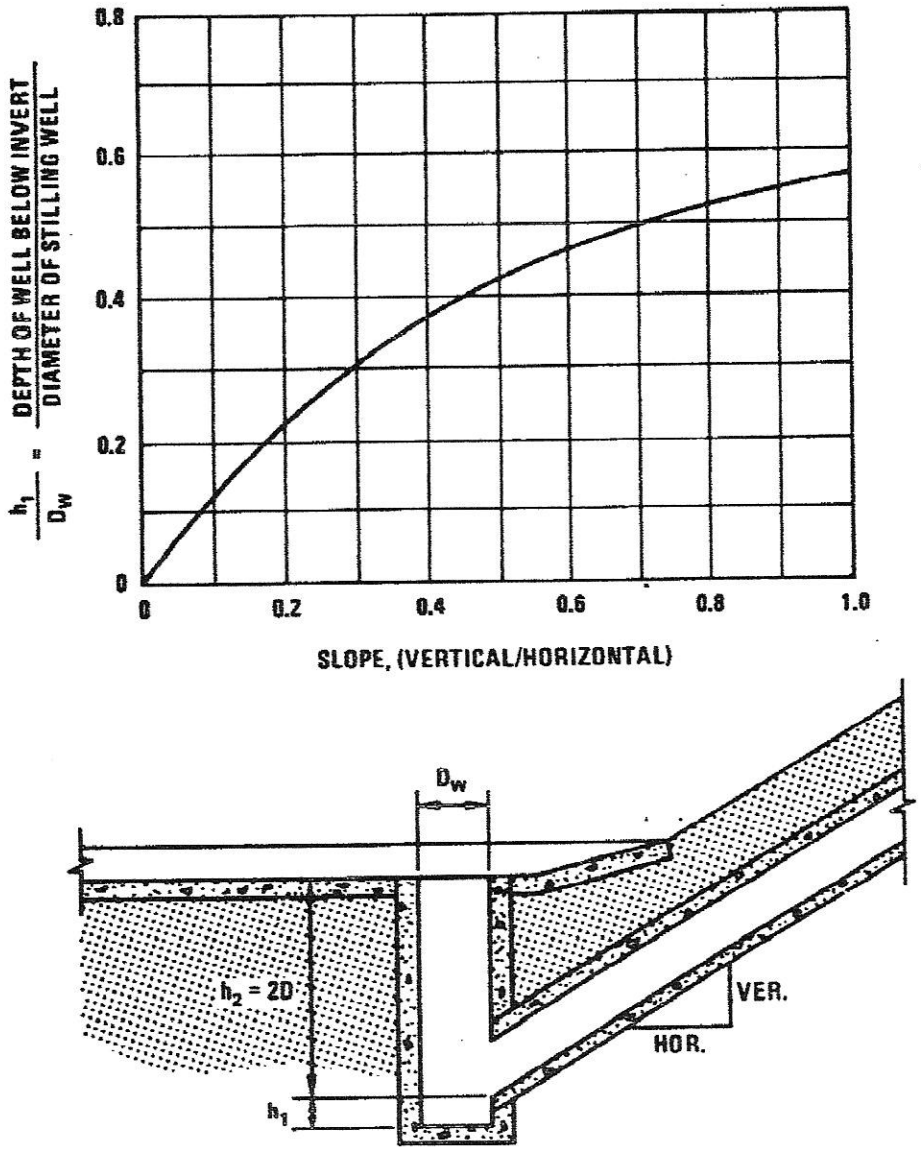


FIGURE X-B-2. STILLING WELL HEIGHT FROM REFERENCE X-B-1

E-3 ENERGY DISSIPATOR MANHOLE DESIGN
MH C1 - SW3

Job Name: **Parklands**
Job Number:
Date: 9/5/16 2:22 PM
Location: Main Outfall - Line C (MH C1) (use same size for MH A1 and MH A1B)

Stilling Well Design

Line C **(Q_{100} is 19.73 cfs)** ***SW3***

Reference: HEC #14, pages X-B-1 thru X-B-4

Design Procedure

1. Determine approach pipe diameterter (D) and discharge (Q). **(Q_{100} is about 19.7cfs)**

2. Determine Well Diameter (D_W) from figure X-B-1.

3. Calculte the culvert slope.

Determine the depth of the well below the culvert invert from figure X-B-2.

4. The depth of the well above the the culvert invert (h2) is equal to 2(D) .
as a minimum but may be greater if the site permits

5. The total height of the well is (hw) = h_1+h_2.

Stilling Well Design
SW3

Given			figure X-B-1	figure X-B-2	min = 2 x (D)	= h_1+h_2
Step 1	Step 1	Step 3	Step 2	Step 3, part 2	Step 4	Step 5
D	Q	Slope (s)	D_W	h_1	h_2	h_w
(ft)	(cfs)	%	(ft)	(ft)	(ft)	(ft)
1.5	19.7	7.42	4.00	2.00	3.00	5.00
	Assumptions		4D*	use 2 ft instead of 0.32**		

***but use 2.67D = 3 ft, since h_1 is being increased**

* find 4D per Fig. X-B-1

and, h_1/D_W = 2 divided by 4 = **0.50**
larger than 0.32, OK

Step 3, part 2

**From Fig. X-B-2 get approx. 0.08 ratio

** Find minimum h_1:

h_1 = D_W x ratio = 0.32 ft

Try 2.0 ft for design

APPENDIX E-4 FLOW DISSIPATION SYSTEM FOR STORM LINE A AND LINE C

Perforated Pipe Dissipation System

The input for modeling the perf pipe dissipation system was developed from rating tables published in an Advanced Drainage System (ADS) publication "Hydraulics Brochure" – outflow From Perforated Pipe 2.105. The published data is in gpm and has been converted to cfs. The data for the 24 inch perf pipe was derived by multiplying the data for an 18" pipe by a factor of 1.33. This is the increase in perforation area/LF in increasing from 18" to 24". The tabulated data was reduced by 50% to account for possible blockage from the rock aggregate placed around the 24 inch perf pipe.

The rating tables are based on a horizontal profile, so this system on a slight slope would have a better outflow rate than in input flow data per stage. The results indicate that the system can adequately manage the inflow. The spread length for the outflow is 180 ft plus 124 ft = 304 LF.

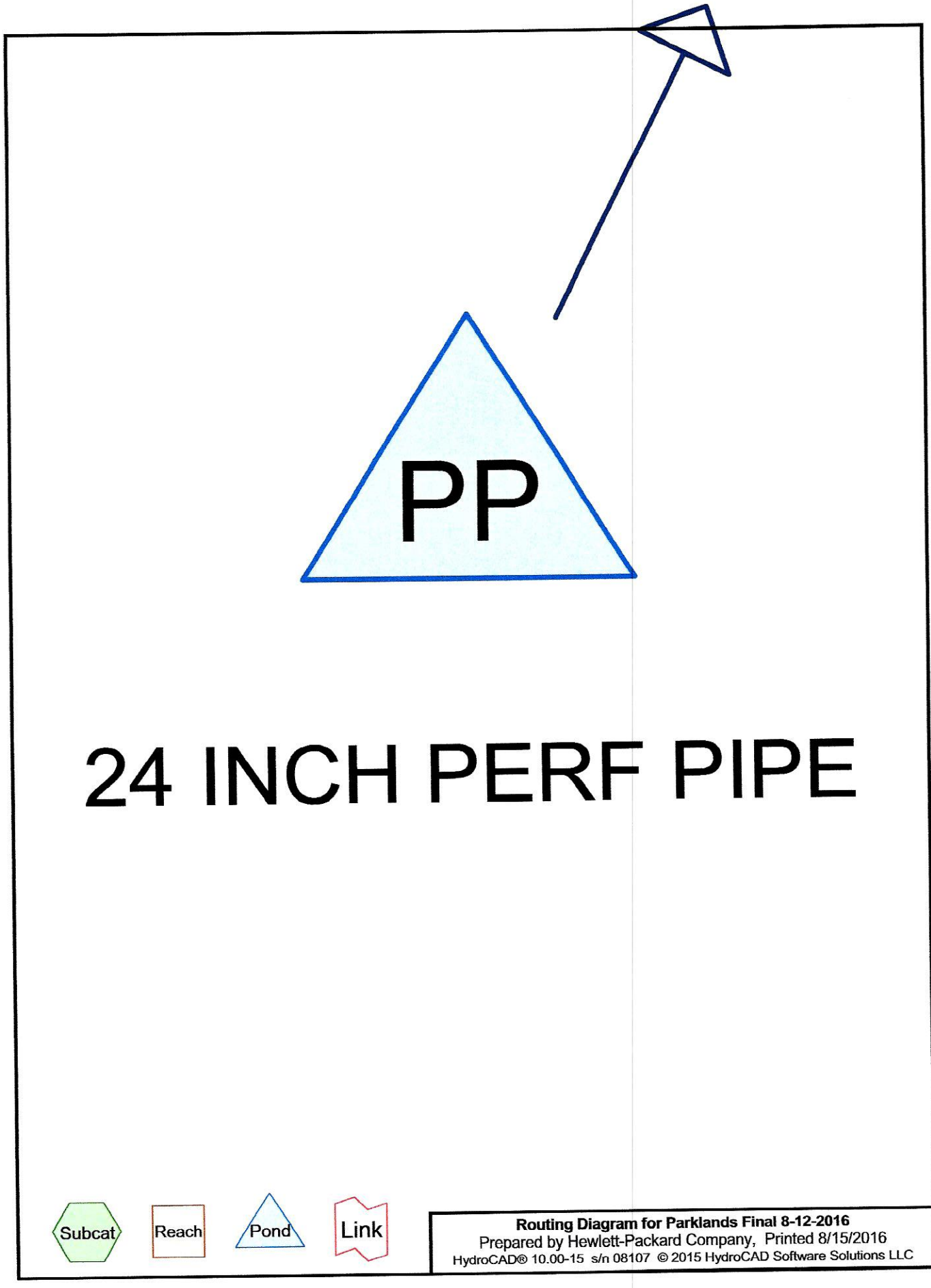
Note: This data is directly from ADS "Hyraulics Brochure" - Outflow from								
	perforated Pipe 2.105				**(Q in cfs has been added)**			
Head (H)	Pipe Dia.	Discharge (Q)	Q		Head (H)	Pipe Dia.	Discharge (Q)	Q
(inches)	(inches)	(gpm/ft)	(cfs/ft)		(inches)	(inches)	(gpm/ft)	(cfs/ft)
0	**6**	0.17	0.0004		0	**8**	0.12	0.0003
2	**6**	4.06	0.0091		2	**8**	4.81	0.0107
4	**6**	9.13	0.0204		4	**8**	10.92	0.0244
6	**6**	15.36	0.0343		6	**8**	18.43	0.0411
8	**6**	22.77	0.0508		8	**8**	27.35	0.0610
10	**6**	31.36	0.0699		10	**8**	37.69	0.0840
12	**6**	41.12	0.0917		12	**8**	49.43	0.1102
14	**6**	52.05	0.1161		14	**8**	62.59	0.1396
16	**6**	64.15	0.1431		16	**8**	77.16	0.1721
18	**6**	77.43	0.1727		18	**8**	93.13	0.2077
					20	**8**	110.52	0.2465
Head (H)	Pipe Dia.	Discharge (Q)	Q		Head (H)	Pipe Dia.	Discharge (Q)	Q
(inches)	(inches)	(gpm/ft)	(cfs/ft)		(inches)	(inches)	(gpm/ft)	(cfs/ft)
0	**10**	0.06	0.0001		0	**12**	-0.05	-0.0001
2	**10**	3.02	0.0067		2	**12**	2.60	0.0058
4	**10**	6.39	0.0142		4	**12**	5.93	0.0132
6	**10**	10.17	0.0227		6	**12**	9.96	0.0222
8	**10**	14.34	0.0320		8	**12**	14.68	0.0327
10	**10**	18.92	0.0422		10	**12**	20.09	0.0448
12	**10**	23.89	0.0533		12	**12**	26.20	0.0584
14	**10**	29.27	0.0653		14	**12**	32.99	0.0736
16	**10**	35.05	0.0782		16	**12**	40.48	0.0903

APPENDIX E-4 FLOW DISSIPATION SYSTEM FOR STORM LINE A AND LINE C

18	**10**	41.23	0.0919		18	**12**	48.67	0.1085
20	**10**	47.82	0.1066		20	**12**	57.54	0.1283
22	**10**	54.80	0.1222		22	**12**	67.11	0.1497
					24	**12**	77.37	0.1725
Head (H)	Pipe Dia.	Discharge (Q)	Q		Head (H)	Pipe Dia.	Discharge (Q)	Q
(inches)	(inches)	(gpm/ft)	(cfs/ft)		(inches)	(inches)	(gpm/ft)	(cfs/ft)
0	**15**	0.04	0.0001		0	**18**	0.04	0.0001
2	**15**	2.25	0.0050		2	**18**	2.51	0.0056
4	**15**	5.02	0.0112		4	**18**	5.96	0.0133
6	**15**	8.34	0.0186		6	**18**	10.37	0.0231
8	**15**	12.21	0.0272		8	**18**	15.76	0.0351
10	**15**	16.64	0.0371		10	**18**	22.11	0.0493
12	**15**	21.63	0.0482		12	**18**	29.42	0.0656
14	**15**	27.18	0.0606		14	**18**	37.71	0.0841
16	**15**	33.28	0.0742		16	**18**	46.96	0.1047
18	**15**	39.93	0.0890		18	**18**	57.19	0.1275
20	**15**	47.14	0.1051		20	**18**	68.38	0.1525
22	**15**	54.91	0.1224		22	**18**	80.53	0.1796
24	**15**	63.24	0.1410		24	**18**	93.66	0.2089
26	**15**	72.12	0.1608		26	**18**	107.75	0.2403
					28	**18**	122.82	0.2739
					30	**18**	138.85	0.3096

HCAD ID - PP represents input for 304 LF of 24" perf pipe

Head (H)	Pipe Dia.	Discharge (Q)	Q		Mult. by	Assume		
(inches)	(inches)	(gpm/ft)	(cfs/ft)		304 LF	50% Flow		
					(cfs)	(cfs)		
0	**24**	0.05	0.0001		0.036147	0.018073		
2	**24**	3.35	0.0075		2.268205	1.134103		
4	**24**	7.94	0.0177		5.385857	2.692929		
6	**24**	13.82	0.0308		9.371031	4.685515		
8	**24**	21.01	0.0468		14.2418	7.120899		
10	**24**	29.47	0.0657		19.98009	9.990043		
12	**24**	39.22	0.0875		26.58589	13.29295		
14	**24**	50.27	0.1121		34.0773	17.03865		
16	**24**	62.60	0.1396		42.43622	21.21811		
18	**24**	76.23	0.1700		51.68074	25.84037		
20	**24**	91.15	0.2033		61.79277	30.89639		
22	**24**	107.35	0.2394		72.77233	36.38617		
24	**24**	124.85	0.2784		84.63748	42.31874		
26	**24**	143.63	0.3203		97.37016	48.68508		
28	**24**	163.72	0.3651		110.9884	55.49421		
30	**24**	185.09	0.4127		125.4742	62.73711		


PP
24 INCH PERF PIPE
Subcat
Reach
Pond
Link
Routing Diagram for Parklands Final 8-12-2016
Prepared by Hewlett-Packard Company, Printed 8/15/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

Summary for Pond PP: 24 INCH PERF PIPE

Inflow Area = 38.351 ac, 36.72% Impervious, Inflow Depth = 4.14" for 100-yr event
Inflow = 36.94 cfs @ 7.97 hrs, Volume= 13.229 af
Outflow = 36.91 cfs @ 7.97 hrs, Volume= 13.229 af, Atten= 0%, Lag= 0.1 min
Primary = 36.91 cfs @ 7.97 hrs, Volume= 13.229 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 192.81' @ 7.97 hrs Surf.Area= 0.013 ac Storage= 0.008 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (710.9 - 710.9)

Volume	Invert	Avail.Storage	Storage Description
#1	192.00'	0.013 af	**24.0" Round Pipe Storage** L= 180.0' S= 0.0028 '/'
#2	191.50'	0.009 af	**24.0" Round Pipe Storage** L= 124.0' S= 0.0040 '/'
		0.022 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	191.00'	**Special & User-Defined** Elev. (feet) 191.00 192.00 193.00 193.50 Disch. (cfs) 0.000 13.290 42.320 62.740

Primary OutFlow Max=36.86 cfs @ 7.97 hrs HW=192.81' TW=188.12' (Dynamic Tailwater)
↑—**1=Special & User-Defined** (Custom Controls 36.86 cfs)

APPENDIX F

Appendix F Offsite Analysis

Note: some flow from Payne road has been added to the model. The difference in depth for the Post analysis is only about 0.01 ft, so this file has not been updated.

APPENDIX F OFFSITE ANALYSIS

The hydraulics/hydrology analysis for this project has determined that development as proposed will not have a significant adverse impact on the downstream and\or upstream drainage system.

The offsite flow path (about 600 LF to Lacamas Lake) was determined from LiDAR data. This data provides spot elevations, from which, cross sections across the flow path route could be developed and input for modeling. The following results were determined.

Historic and Post-development Full Build

Summary of HydroCAD results for 100-yr,24-hr event

Cross-section ID	Depth of Flow (ft)		Depth Increase (ft)	Max. Velocity Post Full Build Max/Ave. (fps)
	Extg	Post		
CH and CP (26R)	0.96	1.29	0.33	0.73/0.27
DH and DP (25R)	1.29	1.54	0.25	0.28/0.11
EH and EP (24R)	0.54	0.67	0.13	2.00/0.85
FH and FP (23R)	0.49	0.65	0.16	1.76/0.62

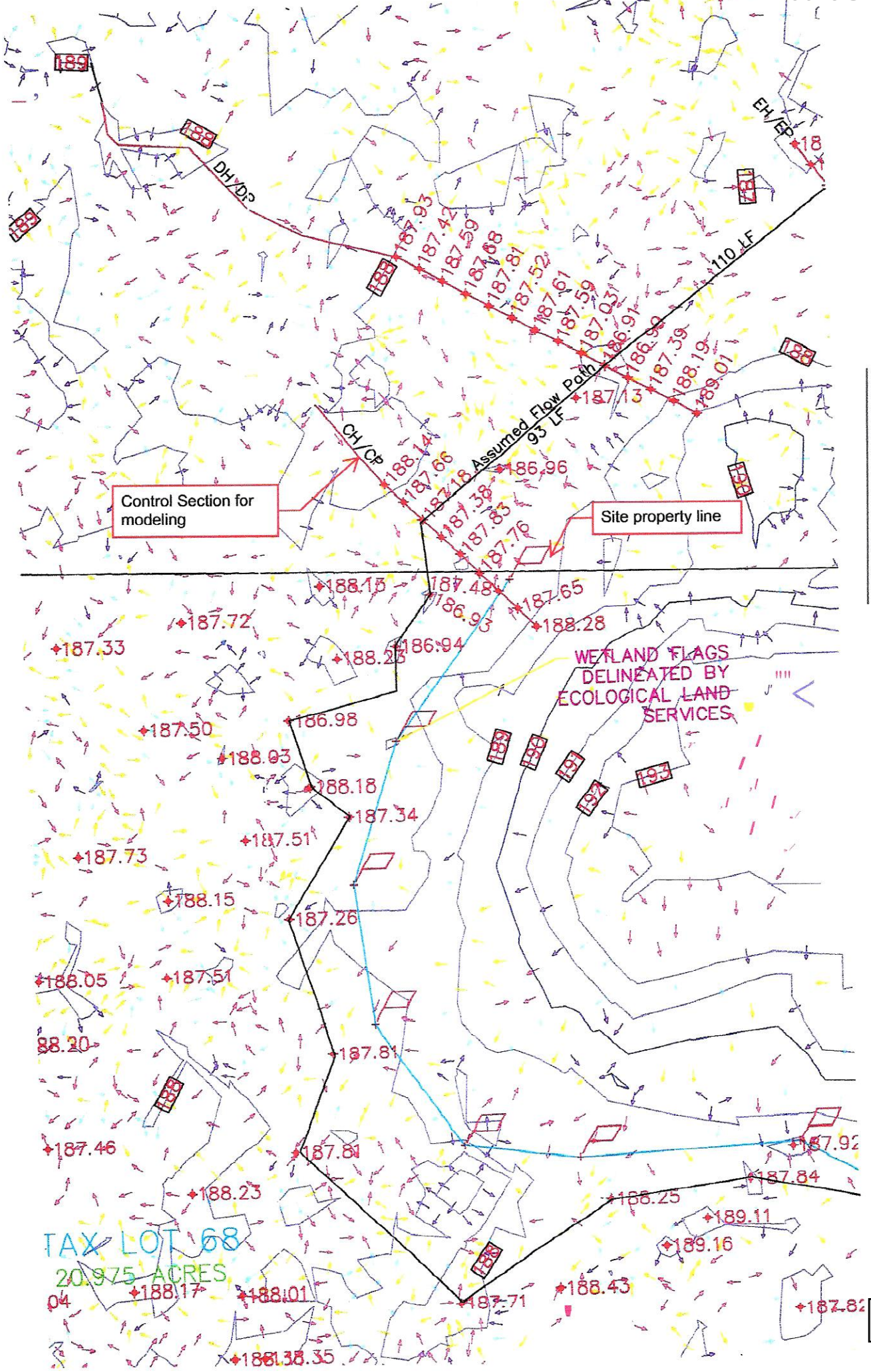
Notes:

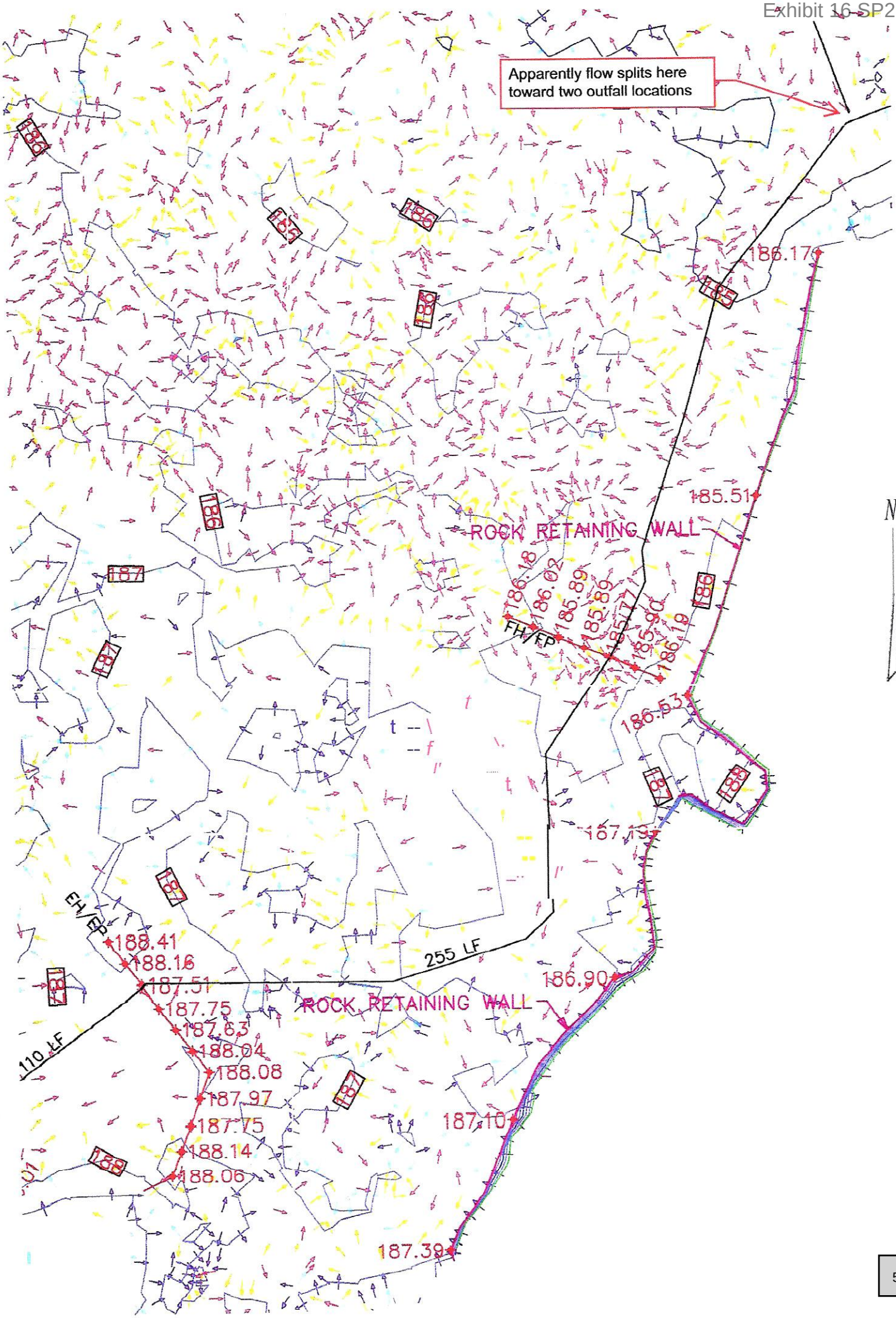
1) The apparent control channel section CH/CP is about 0.25 feet above the low spot elevation. near the property line for the site.

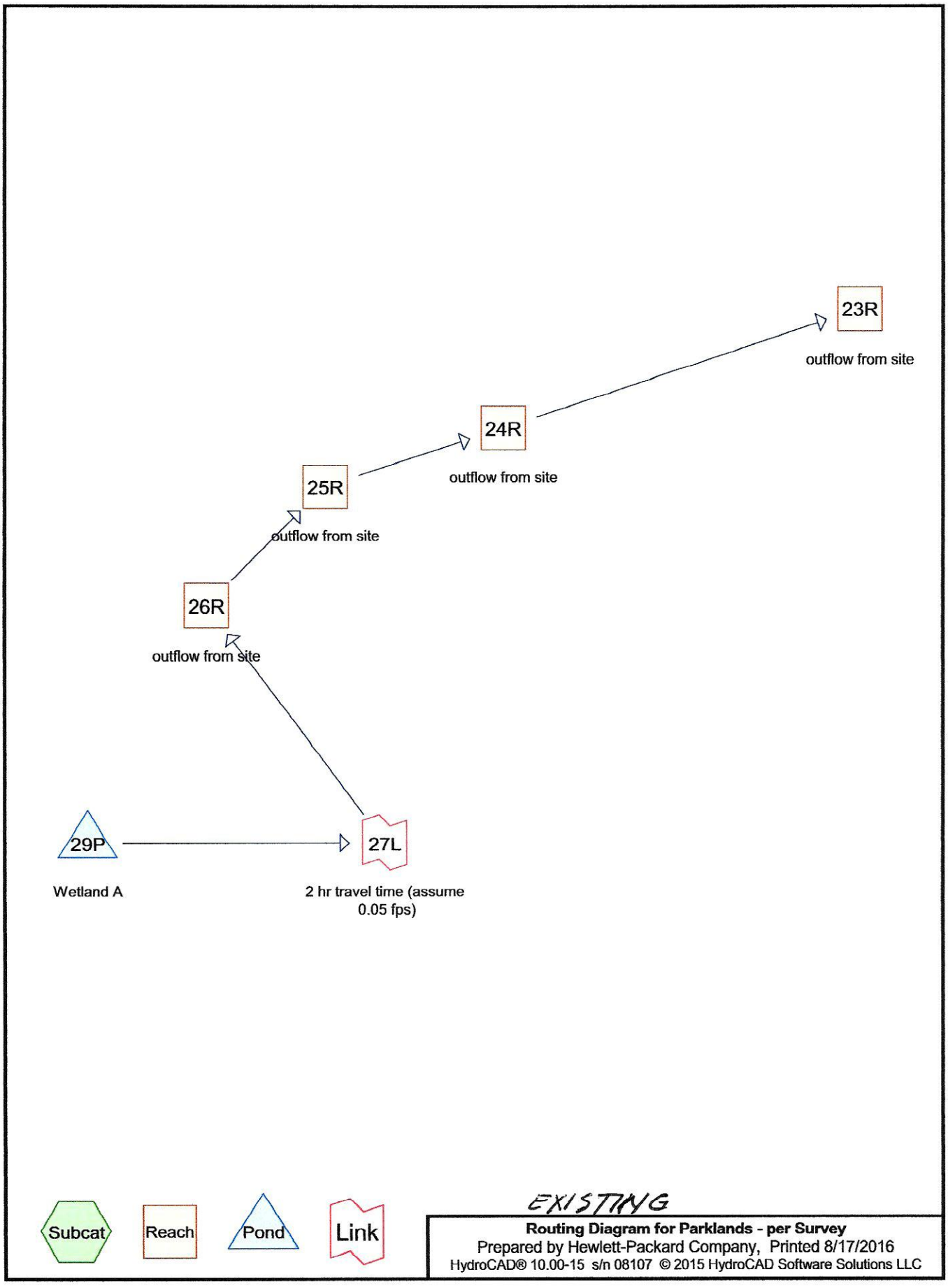
2) There is an effective hydraulic slope to this cross section through the wetland at 0.0025 ft/ft (1.07 ft in 434 LF.

3) The listed velocity along the flow path is below erosive velocities for grass lined flow regimes.

The LiDAR map info with cross section locations and IDs – see on following pages.


DH/DP
EH/EP
110 LF
Assumed Flow Path
93 LF
CH/CP
Control Section for modeling
Site property line
WETLAND FLAGS DELINEATED BY ECOLOGICAL LAND SERVICES
TAX LOT 68
20.975 ACRES
500


Apparently flow splits here toward two outfall locations
186.17
185.51
ROCK RETAINING WALL
186.18
186.02
185.89
185.89
185.17
185.90
186.19
FH/FP
186.53
187.13
255 LF
186.90
ROCK RETAINING WALL
FH/FP
188.41
188.16
187.51
187.75
187.63
188.04
188.08
187.97
187.75
188.14
188.06
110 LF
187.10
187.39
N


23R
outflow from site
24R
outflow from site
25R
outflow from site
26R
outflow from site
29P
Wetland A
27L
2 hr travel time (assume 0.05 fps)
Subcat
Reach
Pond
Link
EXISTING
Routing Diagram for Parklands - per Survey
Prepared by Hewlett-Packard Company, Printed 8/17/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

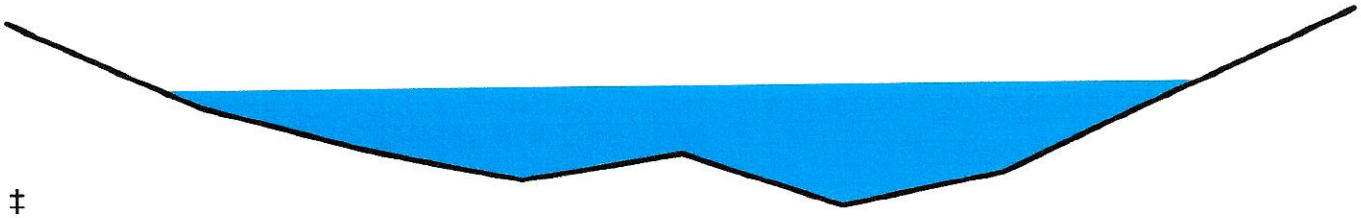
Summary for Reach 23R: outflow from site

Inflow Area = 77.960 ac, 0.00% Impervious, Inflow Depth = 3.25" for 100-yr event
Inflow = 25.61 cfs @ 11.42 hrs, Volume= 21.126 af
Outflow = 25.61 cfs @ 11.49 hrs, Volume= 21.126 af, Atten= 0%, Lag= 4.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3
Max. Velocity= 1.42 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 5.4 min

Peak Storage= 3,881 cf @ 11.45 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 0.76' Flow Area= 38.3 sf, Capacity= 75.41 cfs

Custom cross-section, Length= 215.0' Slope= 0.0045 '/'
Constant n= 0.030
Inlet Invert= 185.77', Outlet Invert= 184.80'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.00	186.53	0.00
0.00	186.19	0.34
10.00	186.02	0.51
20.00	185.89	0.64
30.00	185.99	0.54
40.00	185.77	0.76
50.00	185.90	0.63
60.00	186.19	0.34
72.00	186.53	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.12	0.9	14.7	190	0.45
0.13	1.0	17.7	224	0.53
0.22	3.7	40.8	790	2.46
0.25	4.9	44.1	1,064	3.83
0.42	13.8	60.0	2,967	17.24
0.76	38.3	84.0	8,230	75.41

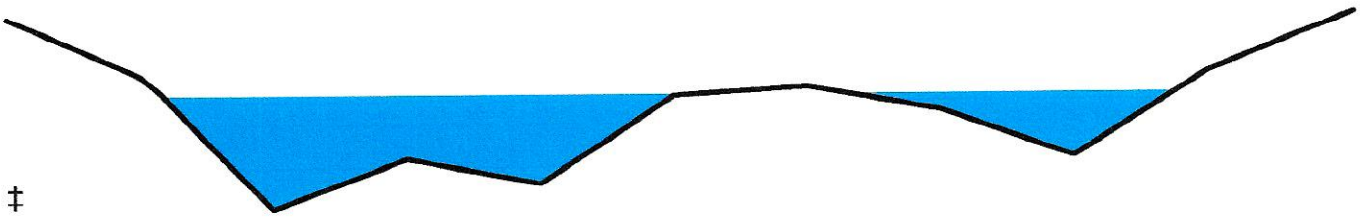
Summary for Reach 24R: outflow from site

Inflow Area = 77.960 ac, 0.00% Impervious, Inflow Depth = 3.25" for 100-yr event
Inflow = 25.63 cfs @ 11.33 hrs, Volume= 21.126 af
Outflow = 25.61 cfs @ 11.42 hrs, Volume= 21.126 af, Atten= 0%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3
Max. Velocity= 1.68 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 4.3 min

Peak Storage= 3,448 cf @ 11.38 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 0.90' Flow Area= 46.8 sf, Capacity= 122.25 cfs

Custom cross-section, Length= 225.0' Slope= 0.0077 '/'
Constant n= 0.030
Inlet Invert= 187.51', Outlet Invert= 185.77'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	188.41	0.00
10.00	188.14	0.27
11.54	188.06	0.35
20.00	187.51	0.90
30.00	187.75	0.66
40.00	187.63	0.78
50.00	188.04	0.37
60.00	188.08	0.33
70.00	187.97	0.44
80.00	187.75	0.66
90.00	188.14	0.27
101.00	188.41	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.12	0.4	6.9	93	0.27
0.24	2.4	26.6	544	2.14
0.46	11.0	51.0	2,466	17.11
0.53	14.9	62.0	3,355	25.07
0.55	16.2	69.6	3,651	26.77
0.57	17.7	77.3	3,982	29.01
0.63	22.4	80.0	5,043	41.79
0.90	46.8	101.0	10,541	122.25

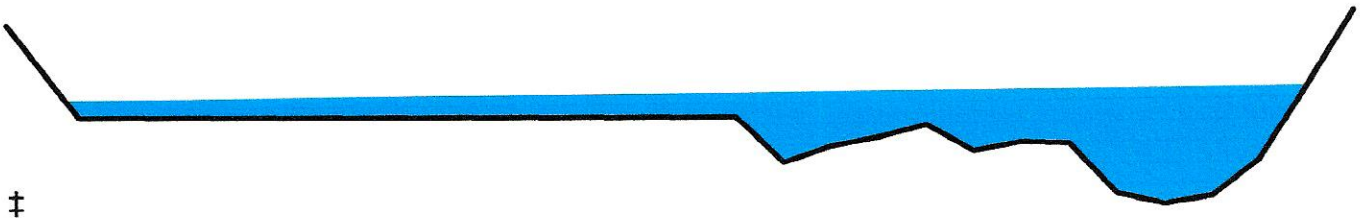
Summary for Reach 25R: outflow from site

Inflow Area = 77.960 ac, 0.00% Impervious, Inflow Depth = 3.25" for 100-yr event
Inflow = 25.66 cfs @ 11.09 hrs, Volume= 21.126 af
Outflow = 25.63 cfs @ 11.33 hrs, Volume= 21.126 af, Atten= 0%, Lag= 14.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3
Max. Velocity= 0.21 fps, Min. Travel Time= 8.6 min
Avg. Velocity = 0.11 fps, Avg. Travel Time= 16.3 min

Peak Storage= 13,299 cf @ 11.18 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 2.09' Flow Area= 338.4 sf, Capacity= 134.98 cfs

Custom cross-section, Length= 110.0' Slope= 0.0001 '/' (105 Elevation Intervals)
Constant n= 0.040
Inlet Invert= 186.91', Outlet Invert= 186.90'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-153.00	189.00	0.00
-138.00	188.00	1.00
0.00	187.93	1.07
10.00	187.42	1.58
20.00	187.59	1.41
30.00	187.68	1.32
40.00	187.81	1.19
50.00	187.52	1.48
60.00	187.61	1.39
70.00	187.59	1.41
80.00	187.03	1.97
90.00	186.91	2.09
100.00	186.99	2.01
110.00	187.39	1.61
116.75	187.93	1.07
120.00	188.19	0.81
130.00	189.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.08	0.7	16.7	74	0.03
0.12	1.4	21.0	156	0.08
0.48	11.8	36.4	1,293	1.96
0.51	12.9	37.4	1,415	2.24
0.61	17.1	48.2	1,886	3.03
0.68	21.1	66.1	2,325	3.50
0.70	22.6	81.8	2,488	3.40
0.77	28.8	94.3	3,166	4.63
0.90	42.2	113.0	4,647	7.77
1.02	56.0	116.8	6,164	11.74
1.09	69.1	255.7	7,597	10.37
1.28	118.1	260.9	12,993	24.67
2.09	338.4	283.1	37,222	134.98

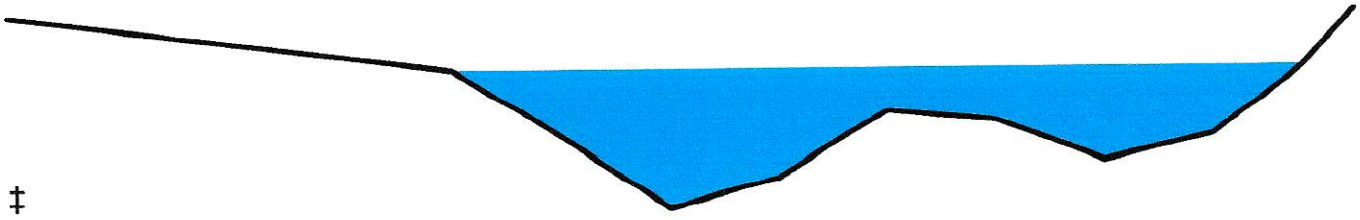
Summary for Reach 26R: outflow from site

Inflow Area = 77.960 ac, 0.00% Impervious, Inflow Depth = 3.25" for 100-yr event
Inflow = 25.67 cfs @ 11.02 hrs, Volume= 21.126 af
Outflow = 25.66 cfs @ 11.09 hrs, Volume= 21.126 af, Atten= 0%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3
Max. Velocity= 0.64 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 5.2 min

Peak Storage= 3,734 cf @ 11.05 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 1.35' Flow Area= 79.4 sf, Capacity= 59.05 cfs

Custom cross-section, Length= 93.0' Slope= 0.0029 '/' (101 Elevation Intervals)
Constant n= 0.080 Earth, long dense weeds
Inlet Invert= 187.18', Outlet Invert= 186.91'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-41.00	188.53	0.00
0.00	188.14	0.39
10.00	187.66	0.87
20.00	187.18	1.35
30.00	187.38	1.15
40.00	187.83	0.70
50.00	187.76	0.77
60.00	187.48	1.05
70.00	187.65	0.88
78.30	188.14	0.39
83.00	188.53	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.20	1.4	14.2	132	0.31
0.30	3.0	18.5	284	0.91
0.47	8.2	41.9	761	2.76
0.48	8.6	42.8	800	2.95
0.58	13.4	52.4	1,243	5.37
0.65	17.5	66.6	1,630	7.22
0.96	40.0	78.4	3,719	25.53
1.35	79.4	124.1	7,387	59.05

Summary for Pond 29P: Wetland A

Inflow Area = 77.960 ac, 0.00% Impervious, Inflow Depth = 3.25" for 100-yr event
Inflow = 28.41 cfs @ 8.08 hrs, Volume= 21.126 af
Outflow = 25.67 cfs @ 9.02 hrs, Volume= 21.126 af, Atten= 10%, Lag= 56.2 min
Primary = 25.67 cfs @ 9.02 hrs, Volume= 21.126 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 187.99' @ 9.02 hrs Surf.Area= 3.001 ac Storage= 0.907 af

Plug-Flow detention time= 24.7 min calculated for 21.113 af (100% of inflow)
Center-of-Mass det. time= 24.7 min (868.2 - 843.5)

Volume	Invert	Avail.Storage	Storage Description
#1	187.40'	5.478 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
187.40	0.050	0.000	0.000
188.00	3.027	0.923	0.923
188.05	3.147	0.154	1.077
189.00	6.117	4.400	5.478

Device	Routing	Invert	Outlet Devices
#1	Primary	187.40'	**Special & User-Defined**

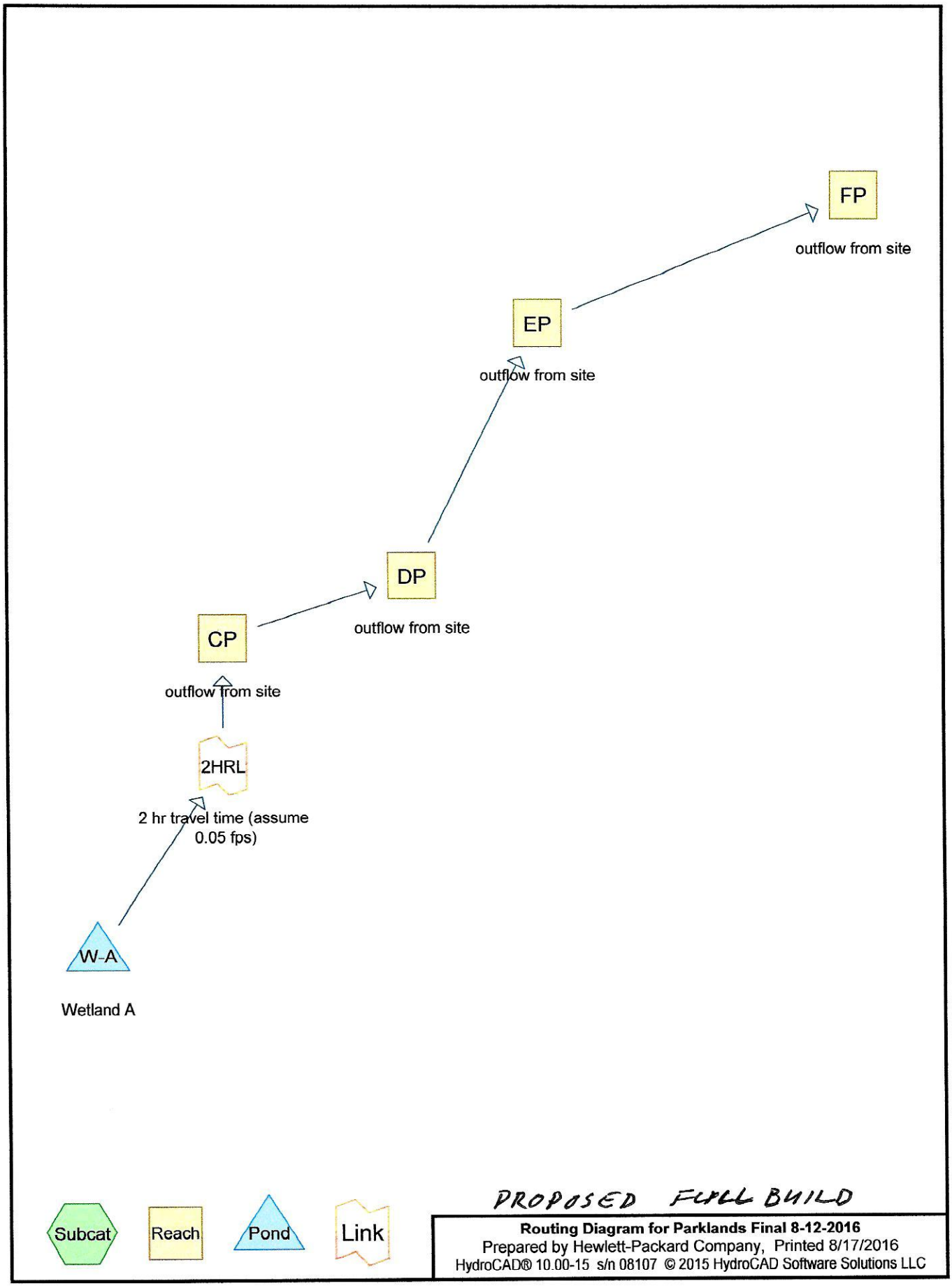
Head (feet)	0.00	0.20	0.40	0.60	0.80
Disch. (cfs)	0.000	2.270	12.170	26.030	71.260

Primary OutFlow Max=25.67 cfs @ 9.02 hrs HW=187.99' (Free Discharge)
↳**1=Special & User-Defined** (Custom Controls 25.67 cfs)

Summary for Link 27L: 2 hr travel time (assume 0.05 fps)

Inflow Area = 77.960 ac, 0.00% Impervious, Inflow Depth = 3.25" for 100-yr event
Inflow = 25.67 cfs @ 9.02 hrs, Volume= 21.126 af
Primary = 25.67 cfs @ 11.02 hrs, Volume= 21.126 af, Atten= 0%, Lag= 120.0 min

Primary outflow = Inflow delayed by 120.0 min, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs


FP
outflow from site
EP
outflow from site
DP
outflow from site
CP
outflow from site
2HRL
2 hr travel time (assume 0.05 fps)
W-A
Wetland A
Subcat
Reach
Pond
Link
PROPOSED FULL BUILD
Routing Diagram for Parklands Final 8-12-2016
Prepared by Hewlett-Packard Company, Printed 8/17/2016
HydroCAD® 10.00-15 s/n 08107 © 2015 HydroCAD Software Solutions LLC

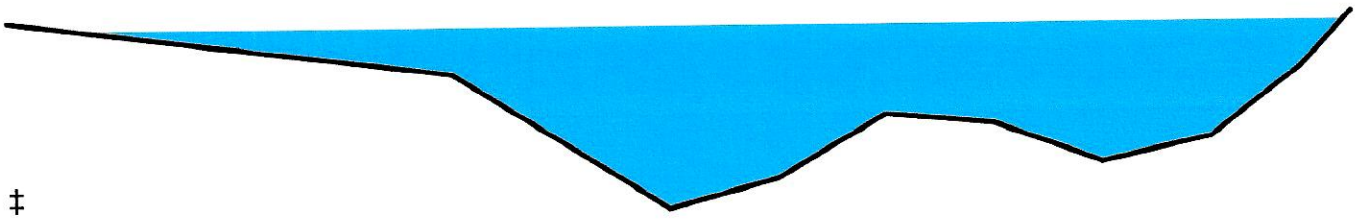
Summary for Reach CP: outflow from site

Inflow Area = 70.207 ac, 31.29% Impervious, Inflow Depth = 3.98" for 100-yr event
Inflow = 52.74 cfs @ 10.14 hrs, Volume= 23.268 af
Outflow = 52.64 cfs @ 10.17 hrs, Volume= 23.268 af, Atten= 0%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 0.73 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 5.7 min

Peak Storage= 6,742 cf @ 10.17 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 1.35' Flow Area= 79.4 sf, Capacity= 59.05 cfs

Custom cross-section, Length= 93.0' Slope= 0.0029 '/' (101 Elevation Intervals)
Constant n= 0.080 Earth, long dense weeds
Inlet Invert= 187.18', Outlet Invert= 186.91'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-41.00	188.53	0.00
0.00	188.14	0.39
10.00	187.66	0.87
20.00	187.18	1.35
30.00	187.38	1.15
40.00	187.83	0.70
50.00	187.76	0.77
60.00	187.48	1.05
70.00	187.65	0.88
78.30	188.14	0.39
83.00	188.53	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.20	1.4	14.2	132	0.31
0.30	3.0	18.5	284	0.91
0.47	8.2	41.9	761	2.76
0.48	8.6	42.8	800	2.95
0.58	13.4	52.4	1,243	5.37
0.65	17.5	66.6	1,630	7.22
0.96	40.0	78.4	3,719	25.53
1.35	79.4	124.1	7,387	59.05

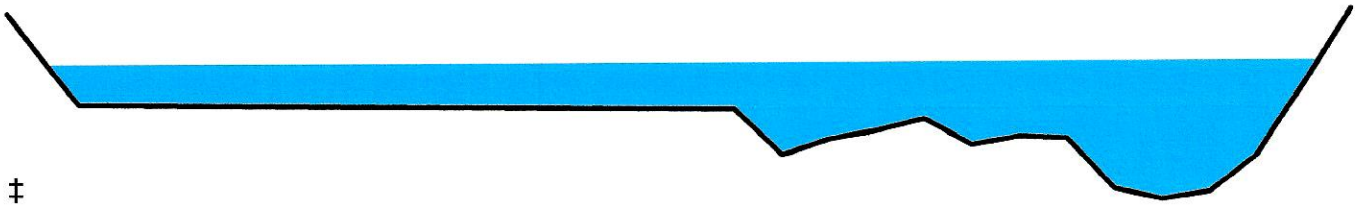
Summary for Reach DP: outflow from site

Inflow Area = 70.207 ac, 31.29% Impervious, Inflow Depth = 3.98" for 100-yr event
Inflow = 52.64 cfs @ 10.17 hrs, Volume= 23.268 af
Outflow = 51.97 cfs @ 10.25 hrs, Volume= 23.268 af, Atten= 1%, Lag= 4.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 0.28 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.11 fps, Avg. Travel Time= 17.3 min

Peak Storage= 20,537 cf @ 10.25 hrs
Average Depth at Peak Storage= 1.54'
Bank-Full Depth= 2.09' Flow Area= 338.4 sf, Capacity= 134.98 cfs

Custom cross-section, Length= 110.0' Slope= 0.0001 '/' (105 Elevation Intervals)
Constant n= 0.040
Inlet Invert= 186.91', Outlet Invert= 186.90'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-153.00	189.00	0.00
-138.00	188.00	1.00
0.00	187.93	1.07
10.00	187.42	1.58
20.00	187.59	1.41
30.00	187.68	1.32
40.00	187.81	1.19
50.00	187.52	1.48
60.00	187.61	1.39
70.00	187.59	1.41
80.00	187.03	1.97
90.00	186.91	2.09
100.00	186.99	2.01
110.00	187.39	1.61
116.75	187.93	1.07
120.00	188.19	0.81
130.00	189.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.08	0.7	16.7	74	0.03
0.12	1.4	21.0	156	0.08
0.48	11.8	36.4	1,293	1.96
0.51	12.9	37.4	1,415	2.24
0.61	17.1	48.2	1,886	3.03
0.68	21.1	66.1	2,325	3.50
0.70	22.6	81.8	2,488	3.40
0.77	28.8	94.3	3,166	4.63
0.90	42.2	113.0	4,647	7.77
1.02	56.0	116.8	6,164	11.74
1.09	69.1	255.7	7,597	10.37
1.28	118.1	260.9	12,993	24.67
2.09	338.4	283.1	37,222	134.98

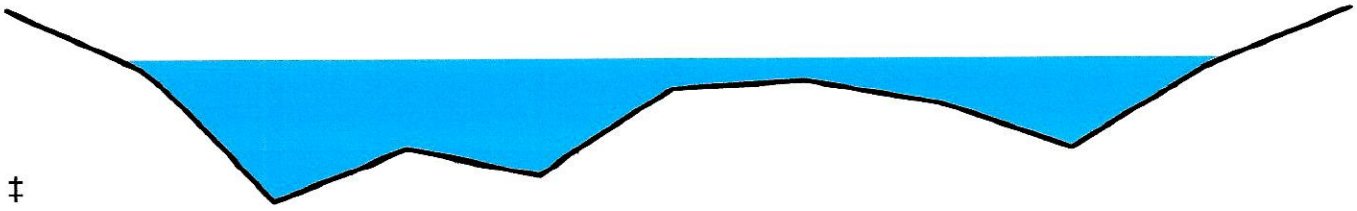
Summary for Reach EP: outflow from site

Inflow Area = 70.207 ac, 31.29% Impervious, Inflow Depth = 3.98" for 100-yr event
Inflow = 51.97 cfs @ 10.25 hrs, Volume= 23.268 af
Outflow = 51.92 cfs @ 10.28 hrs, Volume= 23.268 af, Atten= 0%, Lag= 1.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 2.00 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 4.4 min

Peak Storage= 5,840 cf @ 10.28 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 0.90' Flow Area= 46.8 sf, Capacity= 122.25 cfs

Custom cross-section, Length= 225.0' Slope= 0.0077 '/'
Constant n= 0.030
Inlet Invert= 187.51', Outlet Invert= 185.77'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	188.41	0.00
10.00	188.14	0.27
11.54	188.06	0.35
20.00	187.51	0.90
30.00	187.75	0.66
40.00	187.63	0.78
50.00	188.04	0.37
60.00	188.08	0.33
70.00	187.97	0.44
80.00	187.75	0.66
90.00	188.14	0.27
101.00	188.41	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.12	0.4	6.9	93	0.27
0.24	2.4	26.6	544	2.14
0.46	11.0	51.0	2,466	17.11
0.53	14.9	62.0	3,355	25.07
0.55	16.2	69.6	3,651	26.77
0.57	17.7	77.3	3,982	29.01
0.63	22.4	80.0	5,043	41.79
0.90	46.8	101.0	10,541	122.25

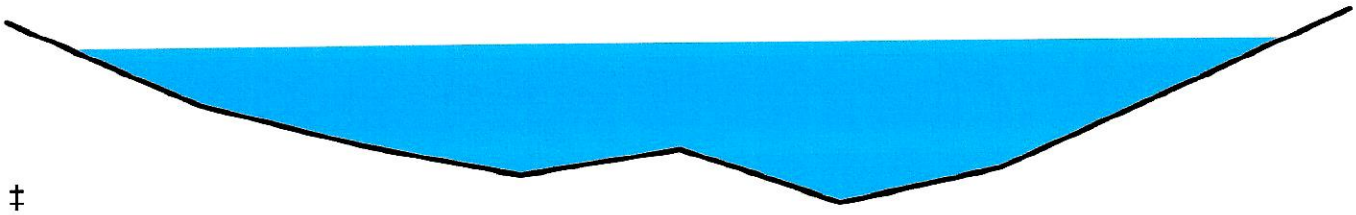
Summary for Reach FP: outflow from site

Inflow Area = 70.207 ac, 31.29% Impervious, Inflow Depth = 3.98" for 100-yr event
Inflow = 51.92 cfs @ 10.28 hrs, Volume= 23.268 af
Outflow = 51.86 cfs @ 10.30 hrs, Volume= 23.268 af, Atten= 0%, Lag= 1.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Max. Velocity= 1.76 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.62 fps, Avg. Travel Time= 5.8 min

Peak Storage= 6,322 cf @ 10.30 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 0.76' Flow Area= 38.3 sf, Capacity= 75.41 cfs

Custom cross-section, Length= 215.0' Slope= 0.0045 '/'
Constant n= 0.030
Inlet Invert= 185.77', Outlet Invert= 184.80'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.00	186.53	0.00
0.00	186.19	0.34
10.00	186.02	0.51
20.00	185.89	0.64
30.00	185.99	0.54
40.00	185.77	0.76
50.00	185.90	0.63
60.00	186.19	0.34
72.00	186.53	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.12	0.9	14.7	190	0.45
0.13	1.0	17.7	224	0.53
0.22	3.7	40.8	790	2.46
0.25	4.9	44.1	1,064	3.83
0.42	13.8	60.0	2,967	17.24
0.76	38.3	84.0	8,230	75.41

Summary for Pond W-A: Wetland A

Inflow Area = 70.207 ac, 31.29% Impervious, Inflow Depth = 3.98" for 100-yr event
Inflow = 58.13 cfs @ 8.00 hrs, Volume= 23.268 af
Outflow = 52.77 cfs @ 8.14 hrs, Volume= 23.268 af, Atten= 9%, Lag= 8.3 min
Primary = 52.77 cfs @ 8.14 hrs, Volume= 23.268 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 188.12' @ 8.14 hrs Surf.Area= 3.360 ac Storage= 1.299 af

Plug-Flow detention time= 23.7 min calculated for 23.254 af (100% of inflow)
Center-of-Mass det. time= 23.7 min (746.9 - 723.3)

Volume	Invert	Avail.Storage	Storage Description
#1	187.40'	5.478 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
187.40	0.050	0.000	0.000
188.00	3.027	0.923	0.923
188.05	3.147	0.154	1.077
189.00	6.117	4.400	5.478

Device	Routing	Invert	Outlet Devices
#1	Primary	187.40'	**Special & User-Defined** Head (feet) 0.00 0.20 0.40 0.60 0.80 Disch. (cfs) 0.000 2.270 12.170 26.030 71.260

Primary OutFlow Max=52.75 cfs @ 8.14 hrs HW=188.12' TW=0.00' (Dynamic Tailwater)
↑—**1=Special & User-Defined** (Custom Controls 52.75 cfs)

Summary for Link 2HRL: 2 hr travel time (assume 0.05 fps)

Inflow Area = 70.207 ac, 31.29% Impervious, Inflow Depth = 3.98" for 100-yr event
Inflow = 52.77 cfs @ 8.14 hrs, Volume= 23.268 af
Primary = 52.74 cfs @ 10.14 hrs, Volume= 23.268 af, Atten= 0%, Lag= 120.1 min

Primary outflow = Inflow delayed by 120.0 min, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

APPENDIX G

G-1 Geotech Report

G-2 Wetland Evaluation Regarding Wetlands Protection

Geotechnical Site Investigation

Parklands at Camas Meadows

Camas, Washington

June 23, 2015

Geotechnical ■ Environmental ■ Special Inspections

Columbia West
Engineering, Inc



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

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

GEOTECHNICAL SITE INVESTIGATION
PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

Prepared For:

Mr. Aaron Barr & Mr. Kevin Deford
Parklands at Camas Meadows, LLC
PO Box 61962
Vancouver, WA 98666

Site Location:

NE of NW Payne Street and NW Camas Meadows Drive Intersection
Parcels 175948000 and 986031650
Camas, Washington

Prepared By:

Columbia West Engineering, Inc.
11917 NE 95th Street
Vancouver, Washington 98682
Phone: 360-823-2900
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Date Prepared:

June 23, 2015

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GEOTECHNICAL SITE INVESTIGATION
PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

1.0 INTRODUCTION

Columbia West Engineering, Inc. was retained by Parklands at Camas Meadows, LLC to conduct a geotechnical site investigation for proposed development on tax parcel numbers 986031650 and 175948000 in Camas, Washington. The purpose of the investigation was to observe and assess subsurface soil conditions at specific locations and provide subsequent appropriate geotechnical engineering analyses to support property development feasibility, planning, and design recommendations. The specific scope of services was outlined in a proposal contract dated May 27, 2015. 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 northeast of the intersection of NW Payne Street and NW Camas Meadows Drive in Camas, Washington. The site is comprised of two tax parcels numbered 986031650 and 175948000 totaling approximately 36.4 acres. The regulatory jurisdictional agency is the City of Camas, Washington. The approximate latitude and longitude are N 45° 37’ 40” and W 122° 26’ 54”, and the legal description is a portion of the SW and SE ¼ of Section 28, T2N, R3E, Willamette Meridian.

1.2 Proposed Development

Review of preliminary site plans provided by the client indicates that proposed development will consist of approximately 46 residential lots and 6 commercial buildings, parking areas, loading docks, private roadways and a future extension of NW Camas Meadows Drive. Stormwater facilities and underground utilities may also be constructed as part of proposed development. Columbia West understands that cut and fill areas 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 within the central portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

According to the *Geologic Map of the Lacamas Quadrangle, Clark County, Washington* (US Geological Survey, Science Investigations Map 2924, 2006), the primary geologic unit present at the site is a Pleistocene gravel facies unit deposited by cataclysmic, glacial-outburst floods associated with Lake Missoula in Montana. However, in the areas explored during subsurface excavation, the unconsolidated boulder to cobbly gravel unit was either extremely thin or missing completely. Instead, the subsurface investigation revealed that the bulk of the site is underlain by two similar sedimentary formations. Test pit exploration indicated that the western corner of the site is underlain by an unnamed, Pleistocene to Pliocene, semi-consolidated, pebble to cobble conglomerate (QTc). This geologic unit is lithologically similar to the Pliocene or late Miocene Troutdale Formation, differing primarily in age of emplacement, degree of weathering, and the presence of hyaloclastite interbeds. Previously published geologic mapping has identified this unit as the Troutdale Formation.

The southern and eastern portion of the site is underlain by the Hyaoclastic sandstone member of the Troutdale formation (Ttfh). This Pliocene to Pleistocene formation is comprised of coarse-grained sandstone and pebble conglomerate containing basalt pebbles and cobbles. This geologic unit is lithologically similar to the Pliocene or late Miocene Troutdale Formation, differing primarily in age of emplacement, degree of weathering, and the presence of hyaloclastite interbeds. Previously published geologic mapping has identified this unit as the Troutdale Formation.

The *Web Soil Survey (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2013 Website)* indicates the site is underlain by three soil types. Hesson clay loam soils are mapped on the majority of the site from the northwest corner to the southwest corner of the property, while Cove silty clay loam and Lauren gravelly loam soils are mapped in the northern and northwestern portions of the property, respectively. Soils resembling the Lauren series were not encountered during subsurface excavation.

Although actual on-site soils may vary from the broad USDA descriptions, Lauren soils are generally coarse-textured, well drained soils with rapid permeability. Cove soils are generally fine-textured, poorly drained soils with very slow permeability and high shrink-swell potential. Hesson soils are fine-textured, well drained soils with moderately slow permeability and moderate shrink-swell potential.

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 17 miles 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 Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene aged Missoula flood deposits.

However, evidence is thought to exist which suggests that fault movement has impacted shallow Holocene deposits and deeper Pleistocene sediments. Seismologists recorded a M3.2 earthquake thought to be associated with the fault zone near Kelly Point Park in November 2012, a M3.9 earthquake thought to be associated with the fault zone near Kelly Point Park in April 2003, and a M3.5 earthquake possibly associated with the 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 possible damaging earthquakes.

Gales Creek-Newberg-Mt. Angel Fault Zone

Located approximately 35 miles 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 the fault zone forms the southwest margin of the Tualatin basin. Possible late-Quaternary 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 rocks of the Columbia River Basalts, and Miocene and Pliocene 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 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 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 Creek Fault and northeast-trending Sandy River Fault intersect north of Camas, Washington approximately 1 mile east 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 Creek fault zone consists of shear contact between the Troutdale Formation and underlying Oligocene 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 surficial deposits have been described. The Lacamas Lake 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 FIELD INVESTIGATION

A geotechnical field investigation consisting of visual reconnaissance and eight test pits (TP-1 through TP-8) was conducted at the site on June 4, 2015. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) specifications. Disturbed soil samples were collected from relevant soil horizons and submitted for laboratory analysis. Laboratory test results are presented in Appendix A. Subsurface exploration locations are indicated on Figure 2. Exploration logs are presented in Appendix B. Soil descriptions and classification information are provided in Appendix C. A photo log is provided in Appendix D.

4.1 Surface Investigation and Site Description

The approximately 36.4-acre subject site occupies two tax parcels to the east of the Camas Meadows Golf Club located at 4105 NW Camas Meadows Drive in Camas, Washington. The site was previously undeveloped and is densely vegetated with large fir and deciduous trees, associated understory vegetation, and a wetland area. The site lies at the toe of a north-facing slope near the western end of Lacamas Lake. Site elevations range from approximately 240 feet elevation in the southern portion of the site to approximately 190 feet elevation along the northern property boundary. Slope grades range from isolated short slopes of approximately 20 percent in the south central portion of the property to generally flat in the wetland area of the northern property boundary. Most slopes are gentle and range from 5 to 10 percent.

4.2 Subsurface Exploration and Investigation

Test pit explorations TP-1 through TP-8 were advanced at the site to a maximum depth of 16.5 feet using a track-mounted excavator on June 4, 2015. Subsurface exploration locations were selected to observe soil characteristics in proximity to proposed development areas and are indicated on Figure 2.

4.2.1 Soil Type Description

The field investigation indicated the site is generally covered with approximately 10 to 18 inches of topsoil and associated organic-rich root zone material at the locations observed. Underlying the topsoil layer, fine-textured silt and clay soils underlain by weathered conglomerate bedrock and competent conglomerate bedrock were encountered. Subsurface lithology may generally be described by the following soil types for engineering purposes.

Soil Type 1 – *Sandy SILT to Sandy FAT CLAY*

Soil Type 1 was observed to consist primarily of medium brown medium stiff, moist to wet, moderate to high plasticity sandy SILT to sandy FAT CLAY. Soil Type 1 was observed underlying the topsoil layer in test pits TP-3 through TP-6 and TP-8 to a maximum depth of 5 feet.

Analytical laboratory testing conducted upon representative soil samples obtained from test pits TP-3 (sandy SILT) and TP-6 (sandy FAT CLAY) indicate approximately 57 to 63 percent by weight passing the No. 200 sieve and in situ moisture content ranging from 32

to 36 percent. Atterberg test results indicated a liquid limit ranging from 44 to 51 percent and a plasticity index ranging from 16 to 25 percent. Soil Type 1 is classified as ML, sandy SILT, and CH, sandy FAT CLAY according to USCS specifications and A-7-6(7) and A-7-6(7) according to AASHTO specifications.

Soil Type 2 – Clayey SAND to Poorly Graded GRAVEL with silt and sand

Soil Type 2 was observed to consist primarily of light brown to multi-colored, dense to very dense, moist to wet, clayey SAND and poorly graded GRAVEL with silt and sand. Soil Type 2 represents weathered conglomerate bedrock. Soil Type 2 was encountered underlying surficial fine textured soils or topsoil in all test pits.

Analytical laboratory testing conducted upon representative soil samples obtained from test pit TP-8 indicate approximately 8 to 20 percent by weight passing the No. 200 sieve and in situ moisture content ranging from 33 to 43 percent. Atterberg test results indicated a liquid limit ranging from 43 to 46 percent and a plasticity index of 18 percent. Soil Type 2 is classified as SC, clayey SAND and GP-GM, poorly-graded GRAVEL with silt and sand according to USCS specifications and A-2-7(0) according to AASHTO specifications.

Soil Type 3: Weathered and Competent Conglomerate Bedrock

Weathered and competent conglomerate bedrock was encountered in all test pits at various depths. The conglomerate bedrock encountered generally resembled the descriptions of the unnamed Pleistocene to Pliocene, semi-consolidated, pebble to cobble conglomerate (QTc) and the Hyaoclastic sandstone member of the Troutdale formation (Ttfh). The bedrock consisted of angular to sub-rounded clasts of various sizes cemented in a matrix of sand, silt, and clay. The bedrock was very dense and excavator refusal was noted at various depths as indicated in Table 1 in Section 5.7, *Excavation.*

4.2.2 Groundwater

Groundwater was encountered in test pits TP-1 and TP-8 at depths of 2.5 feet and 15 feet below ground surface, respectively. Standing water was observed at the ground surface elevation in the wetland which occupies the central north portion of the site. According to *Clark County Maps Online*, the static aquifer elevation in the vicinity of the subject site ranges from 190 to 210 feet amsl. These elevations correspond to an approximate depth to groundwater between 0 and 20 feet below ground surface.

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. Piezometer installation and long-term monitoring, beyond the scope of this investigation, would be necessary to provide more detailed groundwater information.

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. 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 anticipated stripping depth for sod and highly organic topsoil is anticipated to vary from 10 to 18 inches. The required stripping depth may increase in areas of heavy organics, large tree root balls, 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, unsuitable, or undocumented 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.

Site grading activities should be performed in accordance with requirements specified in the 2012 *International Building Code* (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, grading activities, and demolition debris removal verification should be observed and documented by an experienced geotechnical engineer or designated representative.

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 upon prepared subgrade in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within three 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. Engineered fill placement should be observed by an experienced geotechnical engineer or designated representative.

Engineered structural fill placement activities should be performed during dry summer months if possible. If fill placement occurs during dry weather conditions, clean, fine-textured native soils are anticipated be suitable for use as structural fill if adequately

moisture-conditioned to achieve recommended compaction specifications. Areas of sandy FAT CLAY that may be encountered may not be suitable for building foundation subgrade or road subgrade embankments. The use of clay soils for structural fill should be analyzed by Columbia West during site grading activities.

Because they are moisture-sensitive, fine-textured soils such as Soil Type 1 are often difficult to excavate and compact during wet weather conditions. If adequate compaction is not achievable with clean, fine-textured soils, import fill consisting of well-graded granular material with a maximum particle size of three inches and no more than five percent passing the No. 200 sieve is recommended for structural fill.

Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by the geotechnical engineer prior to placement. Laboratory analyses should include particle-size gradation and 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 the geotechnical engineer 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 15 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 by an experienced geotechnical engineer.

5.4 Foundations

Review of preliminary site plans indicates that both residential and commercial/light industrial buildings are proposed. Foundations are anticipated to consist of shallow continuous perimeter or column spread footings. Footings should be designed by a licensed structural engineer and conform to the recommendations below. Typical building

loads are not expected to exceed approximately 3 to 4 kips per foot for perimeter footings or 80 kips per column. If actual loading exceeds anticipated loading, additional analysis should be conducted for the specific load conditions and proposed footing dimensions.

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 upon a 12-inch-thick layer of crushed aggregate base compacted to at least 95 percent of modified Proctor maximum dry density (ASTM D1557) placed on firm competent in situ soil or engineered structural fill. Disturbed surface soils and unsuitable fill should be removed from foundation alignments and replaced with structural fill.

Footings should have a minimum width of 18 inches and extend to a depth at least 18 inches below lowest adjacent grade to provide adequate bearing capacity and protection against frost heave. Foundations constructed during wet weather conditions may require over-excavation of saturated subgrade soils and granular structural backfill prior to concrete placement. Over-excavation recommendations should be provided by a qualified geotechnical engineer during foundation excavation and construction. Excavations adjacent to foundations should not extend within a 1.5H:1V angle projected down from the outside bottom footing edge without additional geotechnical analysis.

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, the estimated allowable bearing capacity for well-drained foundations prepared as described above and bearing on Soil Type 1 is 1,500 psf. The estimated allowable bearing capacity for well-drained foundations bearing upon Soil Types 2 and 3 is 2,000 psf. 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 0.35. Lateral forces may also be resisted by an assumed passive soil equivalent fluid pressure of 250 psf/f against embedded footings. The upper six inches of soil should be neglected in passive pressure calculations.

Foundations should not be permitted to bear upon existing fill, soft soil, or disturbed soil. Because soil is often heterogeneous and anisotropic, it is recommended that an experienced geotechnical engineer or designated representative observe foundation excavations prior to placing forms or reinforcing bar to verify subgrade support conditions are as anticipated in this report.

5.5 Slabs on Grade

The proposed structures may have slab-on-grade floors. Slabs should be supported on firm, competent, in situ 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 1

¼"-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. 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 Settlement

Total long-term static footing displacement for shallow to medium-depth 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 16.5 feet using a track-mounted excavator. As mentioned previously, weathered and competent conglomerate bedrock was encountered in all test pits at various depths ranging from 3 to 16.5 feet below ground surface. Table 1 presents a summary of depths to bedrock and groundwater.

Table 1. *Depth to bedrock and groundwater*.

Test Pit	Depth to Bedrock Refusal (feet below ground surface)	Depth of Seep or Groundwater (feet below ground surface)
TP-1	3	2.5
TP-2	3.5	not encountered
TP-3	4.5	not encountered
TP-4	3	not encountered
TP-5	4.5	not encountered
TP-6	6.5	not encountered
TP-7	3.5	not encountered
TP-8	16.5	15

The conglomerate was generally weathered in the top few feet, but became dense and massive with depth. If significant utilities or other excavations are designed at elevations that encounter bedrock, specialized rock-excavation techniques or blasting may be necessary. As mentioned previously, groundwater seeps were also observed during the site investigation, often at a depth coincident with the soil-to-bedrock interface.

Near-surface soils are likely classified as 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.

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 Dewatering

Groundwater elevation and hydrostatic pressure should be carefully considered during design of utilities, retaining walls, or other structures that require below-grade excavation. As described previously, groundwater may be encountered in the vicinity of proposed development areas. Utility trenches in shallow groundwater areas or excavations and cuts that remain open for even short periods of time may undermine or collapse due to groundwater effects. Placement of layers of riprap or quarry spalls in localized areas on shallow excavation side slopes may be required to limit instability. Over-excavation and stabilization of pipe trenches or other excavations with imported crushed aggregate or gabion rock may also be necessary to provide adequate subgrade support.

Pumping and dewatering may be required to temporarily reduce the groundwater elevation to allow construction of proposed below-grade structures, installation of utilities, or placement of structural fills. Dewatering via a sump within excavation zones may be insufficient to control groundwater and provide excavation side slope stability. Dewatering may be more feasibly conducted by installing a system of temporary well points and pumps around proposed excavation areas or utility trenches. Depending on proposed utility depths, a site-specific dewatering plan may be necessary. Well pumps should remain functioning at all times during the excavation and construction period. Suitable back-up pumps and power supplies should be available to prevent unanticipated shut-down of dewatering equipment. Failure to operate pumps full-time may result in flooding of the excavation zones, resulting in damage to forms, slopes, or equipment.

5.9 Lateral Earth Pressure

If retaining walls are proposed, lateral earth pressures should be carefully considered for design. Hydrostatic pressure and additional surcharge loading should also be considered. Retained material may include engineered structural backfill or undisturbed 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 in situ undisturbed native soils and engineered structural fill consisting of imported granular fill meeting WSDOT specifications for *Gravel Backfill for Walls 9-03.12(2)* are presented in Table 1. Soil Type 1 is excluded due to the relative thin profile observed on the site.

The design parameters presented in Table 2 are valid for static loading cases. The recommended earth pressures do not include surcharge loads, dynamic loading, hydrostatic pressure, or seismic design.

Table 2. Lateral Earth Pressure Parameters for Level Backfill

Backfill Material	Equivalent Fluid Pressure for Level Backfill			Wet Density	Drained Internal Angle of Friction
	At-rest	Active	Passive		
WSDOT 9-03.12(2) compacted aggregate backfill	54 pcf	33 pcf	589 pcf	135 pcf	38°
In situ undisturbed clayey SAND and Poorly Graded GRAVEL with silt and sand (Soil Type 2)	64 pcf	43 pcf	360 pcf	125 pcf	29°

** 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.*

If seismic design is required, 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 wall.

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 drainpipe design are presented in Section 5.12, *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 the geotechnical engineer or designated representative during construction.

5.10 Seismic Design Considerations

According to the *United States Geologic Survey (USGS) 2010 ASCE 7 Seismic Design Maps Summary Report,* the anticipated peak ground and maximum considered earthquake spectral response accelerations resulting from seismic activity for the subject site are summarized in Table 3.

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 and Fv as defined in 2012 IBC Tables 1613.3.3(1) and (2). 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 site soils may be represented by Site Class C. Based upon observed subsurface soil conditions at the site, and review of well logs and local

geologic maps, site soils may be considered to be Site Class C as defined in 2012 IBC Section 1613.3.5. This site class designation indicates that some amplification of seismic energy may occur during a seismic event because of subsurface conditions. This assessment is preliminary and is based upon limited field exploration and research of existing published literature. Additional exploration would be necessary to provide soil site class information at greater depths.

Table 3. 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	0.38 g
0.2 sec Spectral Acceleration	0.89 g
1.0 sec Spectral Acceleration	0.38 g

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 for the site is beyond the scope of this investigation. If site structures are designed in accordance with recommendations specified in the 2012 IBC, the potential for peak ground accelerations in excess of the adjusted and amplified values should be understood.

5.11 Soil Liquefaction and Dynamic Settlement

According to the *Alternative 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 or non-plastic silt 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.

Based upon the results of the geotechnical investigation, the potential for liquefaction of shallow soils at the site is considered to be low.

5.12 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. Concentrated discharge of water should be prohibited across slopes and water should not be diverted, routed, or allowed to flow over or across slope faces.

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 AOS between No. 70 and No. 100 sieve. The water permittivity should be greater than 1.5/sec. Figure 5 presents a typical foundation 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 the geotechnical engineer 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. The geotechnical engineer should be consulted to provide appropriate recommendations.

5.13 Bituminous Asphalt and Portland Cement Concrete

Preliminary site plans indicate that proposed development includes private asphalt concrete driveways and parking areas. Additionally, an extension of the City of Camas' NW Camas Meadows Drive may be constructed as part of the development. Pavement section thickness should be carefully considered to provide adequate lifespan and

serviceability. Pavement section design is outside the scope of this investigation; however, Columbia West can provide section design services in the future if requested. Columbia West recommends adherence to the City of Camas standards for public works construction if improvements to public roads are proposed.

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 later in Section 5.14, *Wet Weather Construction Methods and Techniques*. Areas proposed for asphalt pavement construction should be prepared as described in Section 5.1, *Site Preparation and Grading*. Subgrade conditions should be evaluated and tested by a licensed geotechnical engineer or designated representative prior to placement of crushed aggregate base. Subgrade evaluation should include nuclear gauge density testing and wheel proof-roll observations conducted with a 12-cubic yard, double-axle dump truck or equivalent. Nuclear gauge density testing should be conducted at 250-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 D698. Areas of observed deflection or rutting during proof-roll evaluation should be excavated to a firm surface and replaced with compacted crushed aggregate.

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 should be installed in accordance with the City of Camas specifications. Aggregate base should be observed and proof-rolled in the presence of an experienced geotechnical engineer or designated representative. 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 specimen at a frequency of four cylinders per 100 cubic yards of poured concrete. Recommended field and analytical laboratory 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, 4-inch by 6-inch gabion, or other similar material (6-inch maximum size with less than 5 percent passing the No. 200 sieve).

Construction equipment traffic across exposed fine-textured soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for soils above plastic limit. Wet weather construction may

generate significant excess quantities of soft wet soil, which should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Road base should consist of 3"-0 or 1¼"-0 crushed aggregate and should be placed on previously stripped and structurally competent subgrade. Over-excavation may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric such as Mirafi 500X or an approved equivalent is also recommended. Crushed aggregate base should be installed in a single lift with trucks end-dumping from an advancing layer of granular fill. During extended wet periods, stripping activities may also need to be conducted from an advancing layer 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 subgrade performance.

It should be understood that wet weather construction is risky and costly. An experienced geotechnical engineer or designated representative 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 tactifier, 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 species. 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 Soil Shrink/Swell Potential

Based upon laboratory analysis, subsurface soils contain as much as 63 percent by weight passing the No. 200 sieve and exhibit a plasticity index ranging from 16 to 25 percent. This indicates low to moderate potential for soil shrinking or swelling.

5.17 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 crushed aggregate or other coarse-textured, free-draining material acceptable to the client, City of Camas, and the site geotechnical engineer. 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 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. Even 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 significantly 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.

Daniel E. Lehto, PE, GE
Principal



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FIGURES



MAP SOURCE: Google Maps 2014

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Design	Drawn: ASR		
Checked: DEL	Date: 6/12/15		
Client: PACM, LLC	Rev	By	Date
Job No.: 15153			
CAD File: FIGURE 1			
Scale: ~1:50,000			

SITE LOCATION MAP

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE 1



NOTES:
1. SITE LOCATION: 2150 NE IONE STREET.
2. DRAWING IS NOT TO SCALE.
3. BASE MAP OBTAINED FROM BING MAPS.
4. TEST PIT LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
5. SOIL BOTING BACKFILLED WITH BENTONITE ON 6-26-2013.

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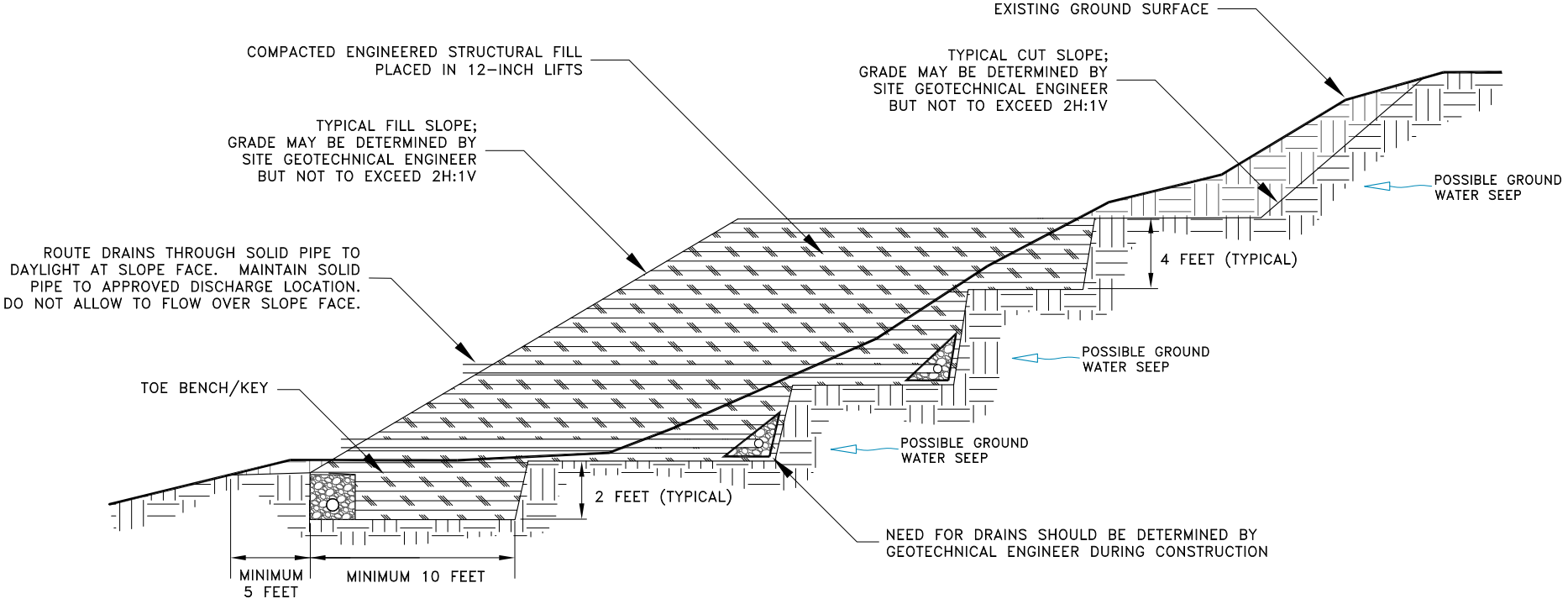
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Checked: DEL	Date: 6/12/15			
Client: PACM, LLC	Rev	By	Date	
Job No: 15153				
CAD File: FIGURE 2				
Scale: NONE				

SUBSURFACE EXPLORATION LOCATION MAP

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE
543

TYPICAL CUT AND FILL SLOPE CROSS-SECTION

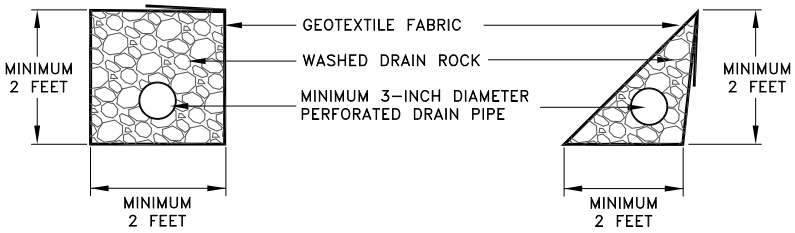


DRAIN SPECIFICATIONS

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.

TYPICAL DRAIN SECTION DETAIL



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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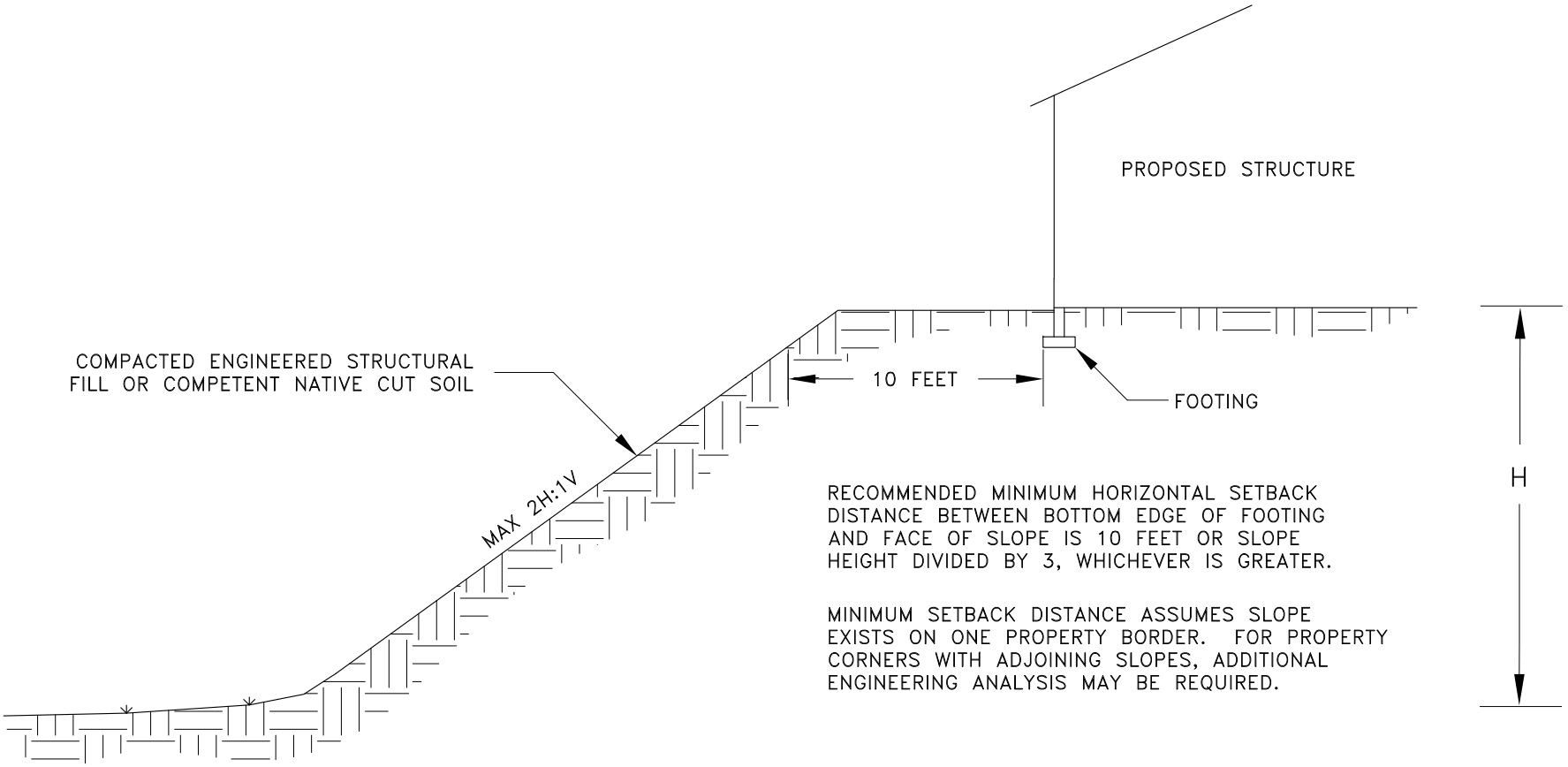
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Checked: DEL	Date: 6/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 3			
Scale: NONE			

TYPICAL CUT AND FILL SLOPE CROSS–SECTION

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE 3

TYPICAL CUT AND FILL SLOPE CROSS-SECTION



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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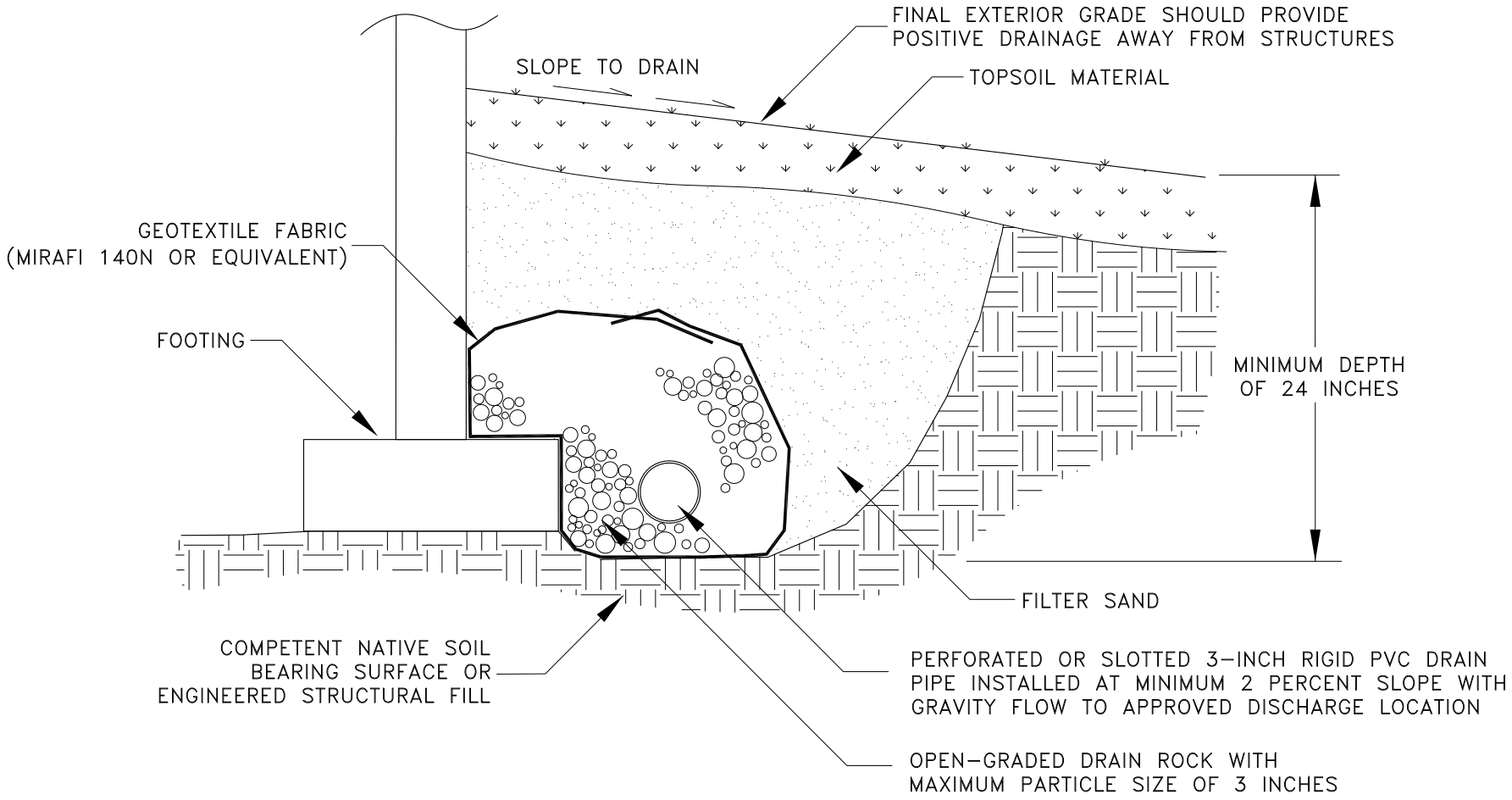
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Checked: DEL	Date: 06/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 4			
Scale: NONE			

MINIMUM FOUNDATION SLOPE SETBACK DETAIL

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE
545

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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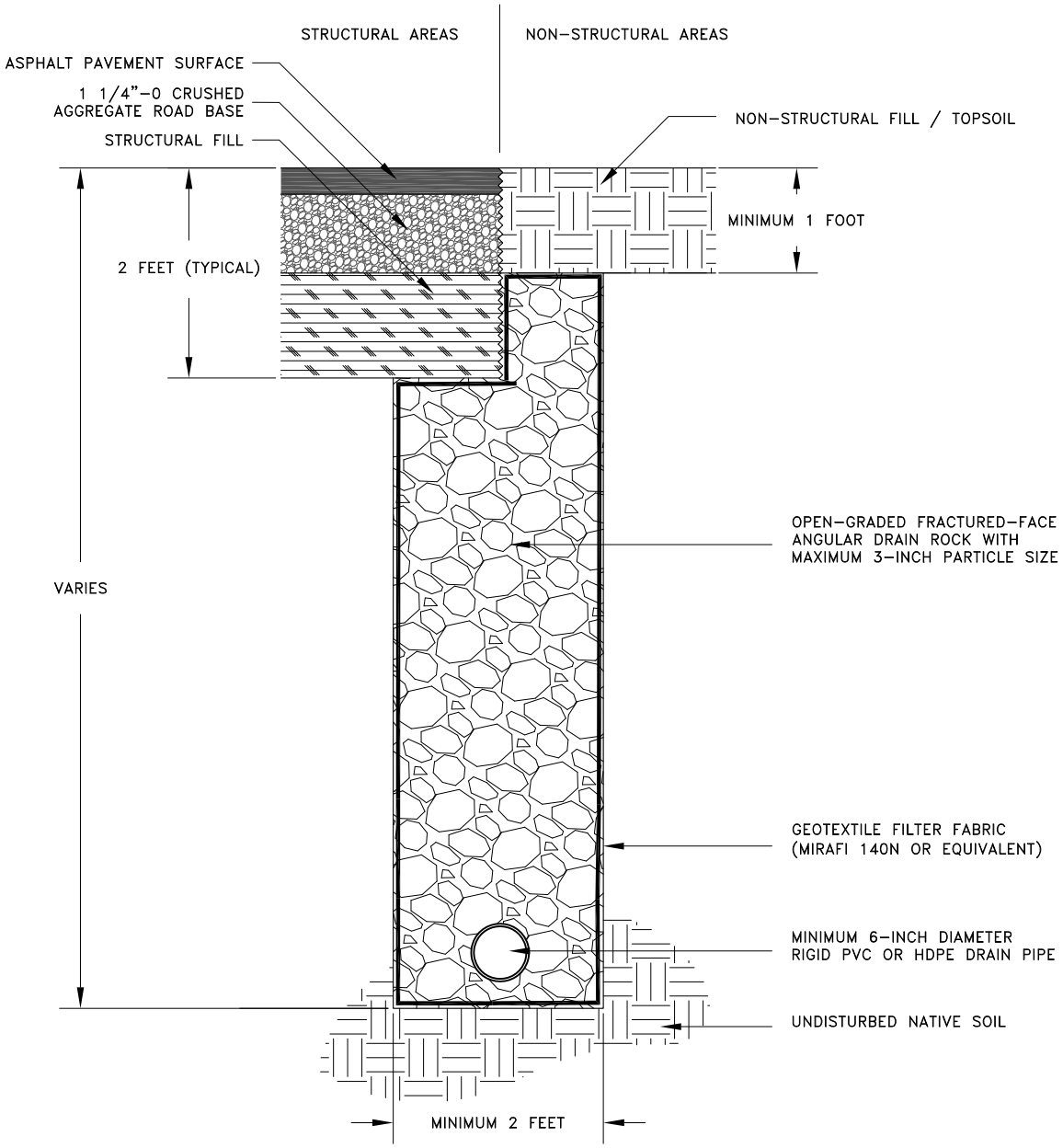
Design:	Drawn: ASR		
Checked: DEL	Date: 6/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 5			
Scale: NONE			

TYPICAL PERIMETER FOOTING DRAIN DETAIL

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE
546

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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Checked: DEL	Date: 06/12/15		
Client: PACM, LLC	Rev	By	Date
Job No: 15153			
CAD File: FIGURE 6			
Scale: NONE			

TYPICAL PERFORATED DRAIN PIPE TRENCH DETAIL

PARKLANDS AT CAMAS MEADOWS
CAMAS, WASHINGTON

FIGURE 6

APPENDIX A
ANALYTICAL LABORATORY TEST RESULTS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-359
		REPORT DATE 06/16/15	FIELD ID TP3.1
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy SILT	Test Pit TP-03 depth = 2 feet	ML, Sandy Silt
SPECIFICATIONS none		AASHTO SOIL TYPE A-7-6(7)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

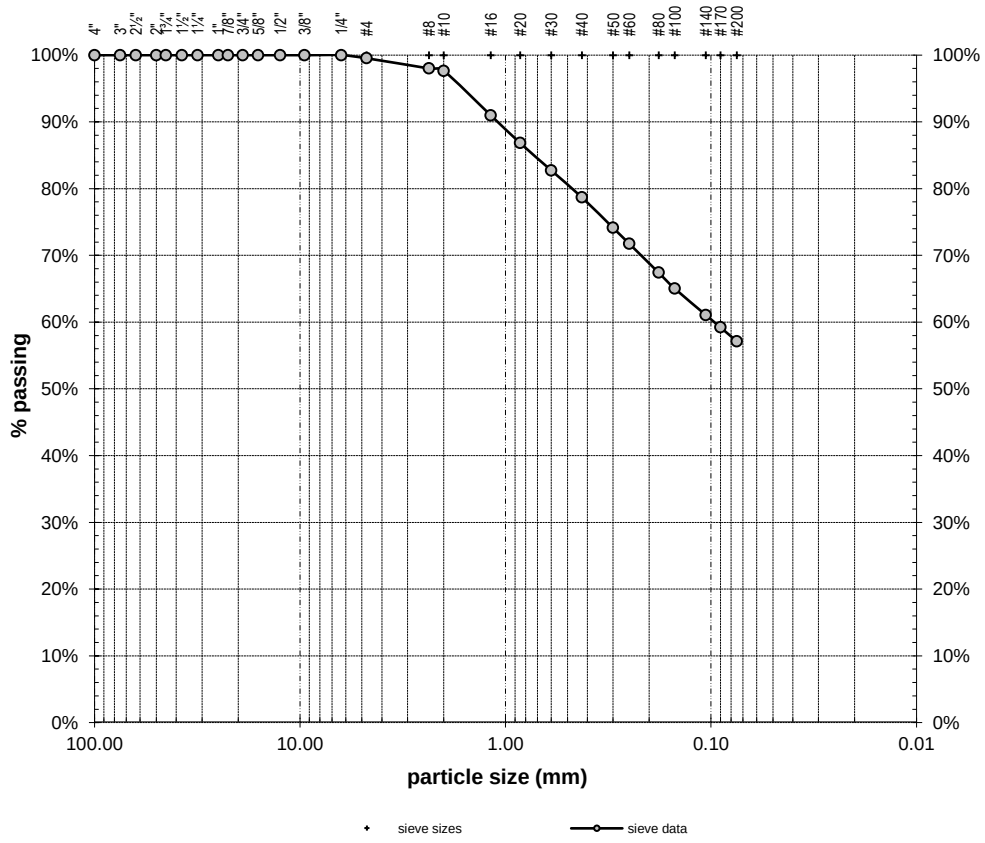
ADDITIONAL DATA

initial dry mass (g) =	158.3		
as-received moisture content =	36.4%	coefficient of curvature, C_C =	n/a
liquid limit =	44	coefficient of uniformity, C_U =	n/a
plastic limit =	28	effective size, $D_{(10)}$ =	n/a
plasticity index =	16	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	0.097 mm

SIEVE DATA

% gravel =	0.5%
% sand =	42.4%
% silt and clay =	57.1%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30	100.0%			
	#4	4.75	99.5%			
SAND	#8	2.36		98.0%		
	#10	2.00	97.6%			
	#16	1.18		91.0%		
	#20	0.850	86.8%			
	#30	0.600		82.7%		
	#40	0.425	78.7%			
	#50	0.300		74.1%		
	#60	0.250	71.7%			
	#80	0.180		67.4%		
	#100	0.150	65.0%			
	#140	0.106		61.1%		
	#170	0.090		59.2%		
	#200	0.075	57.1%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
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		REPORT DATE: 06/16/15	FIELD ID: TP3.1
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy SILT	Test Pit TP-03 depth = 2 feet	ML, Sandy Silt

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit = 44
plastic limit = 28
plasticity index = 16

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	33.30	33.31	33.93	
dry soil + pan weight, g =	29.59	29.37	29.72	
pan weight, g =	20.83	20.70	20.68	
N (blows) =	30	20	15	
moisture, % =	42.4 %	45.4 %	46.6 %	

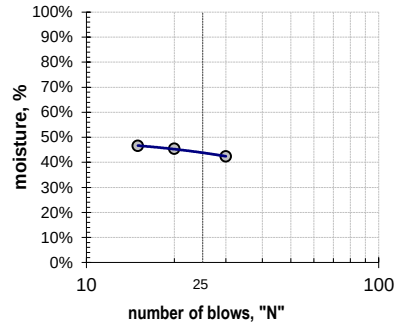
SHRINKAGE

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

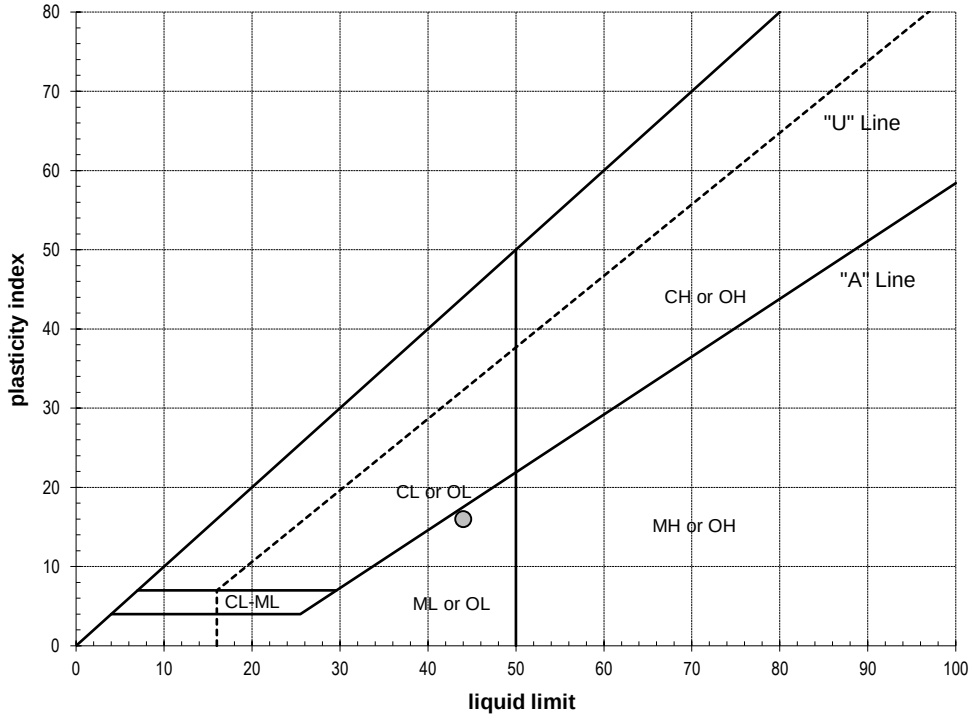
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.85	27.97		
dry soil + pan weight, g =	26.28	26.35		
pan weight, g =	20.69	20.50		
moisture, % =	28.1 %	27.7 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.5%
% sand =	42.4%
% silt and clay =	57.1%
% silt =	n/a
% clay =	n/a
moisture content =	36.4%

DATE TESTED	TESTED BY
06/15/15	MJR

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-360
		REPORT DATE 06/16/15	FIELD ID TP6.1
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Fat CLAY	Test Pit TP-06 depth = 2.5 feet	CH, Sandy Fat Clay
SPECIFICATIONS none		AASHTO SOIL TYPE A-7-6(14)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

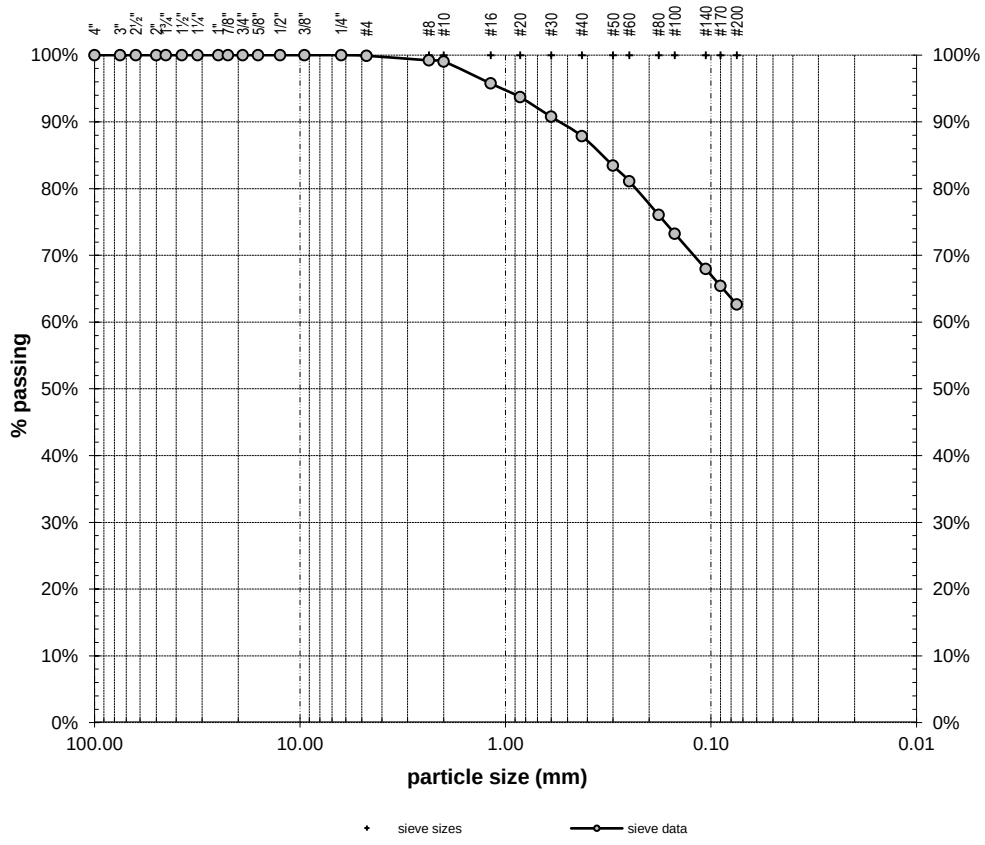
ADDITIONAL DATA

initial dry mass (g) =	173.4		
as-received moisture content =	32.3%	coefficient of curvature, C_C =	n/a
liquid limit =	51	coefficient of uniformity, C_U =	n/a
plastic limit =	26	effective size, $D_{(10)}$ =	n/a
plasticity index =	25	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel =	0.1%
% sand =	37.3%
% silt and clay =	62.6%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30	100.0%			
	#4	4.75	99.9%			
SAND	#8	2.36		99.2%		
	#10	2.00	99.0%			
	#16	1.18		95.7%		
	#20	0.850	93.7%			
	#30	0.600		90.8%		
	#40	0.425	87.9%			
	#50	0.300		83.4%		
	#60	0.250	81.1%			
	#80	0.180		76.1%		
	#100	0.150	73.2%			
	#140	0.106		67.9%		
	#170	0.090		65.4%		
	#200	0.075	62.6%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

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		REPORT DATE: 06/16/15	FIELD ID: TP6.1
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Fat CLAY	Test Pit TP-06 depth = 2.5 feet	CH, Sandy Fat Clay

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	51
plastic limit =	26
plasticity index =	25

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	34.63	34.09	37.32	
dry soil + pan weight, g =	30.07	29.61	31.60	
pan weight, g =	20.69	20.73	20.85	
N (blows) =	33	25	15	
moisture, % =	48.6 %	50.5 %	53.2 %	

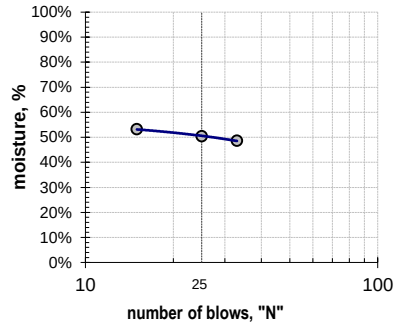
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shrinkage limit =	n/a
shrinkage ratio =	n/a

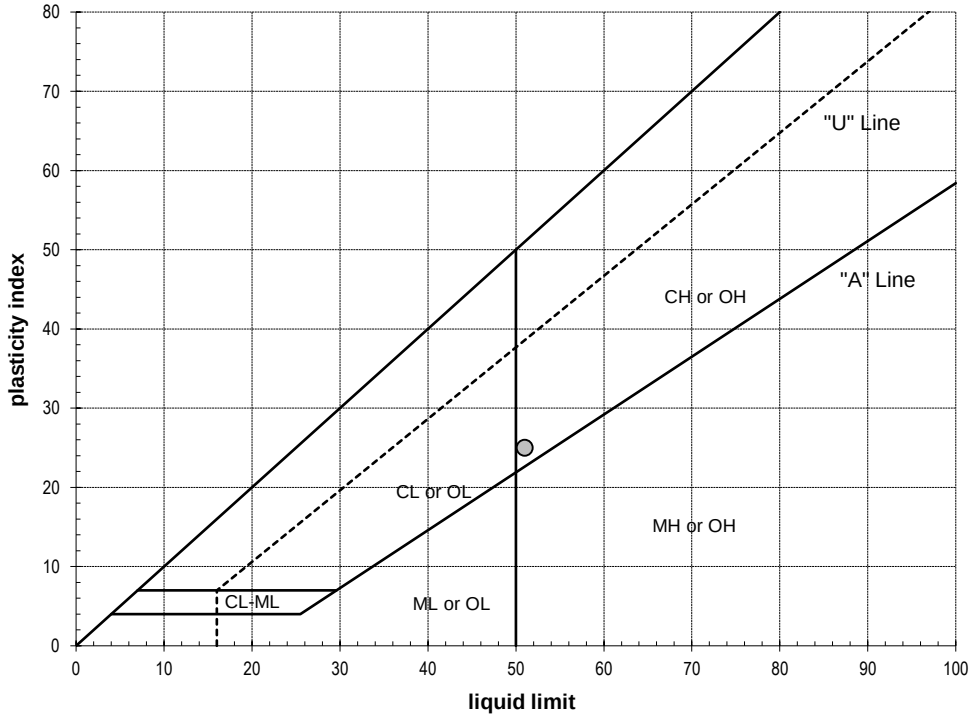
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.64	27.63		
dry soil + pan weight, g =	26.18	26.21		
pan weight, g =	20.69	20.82		
moisture, % =	26.6 %	26.4 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.1%
% sand =	37.3%
% silt and clay =	62.6%
% silt =	n/a
% clay =	n/a
moisture content =	32.3%

DATE TESTED	TESTED BY
06/15/15	MJR

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-361
		REPORT DATE 06/16/15	FIELD ID TP8.2
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Clayey SAND	Test Pit TP-08 depth = 8 feet	SC, Clayey Sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-2-7(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

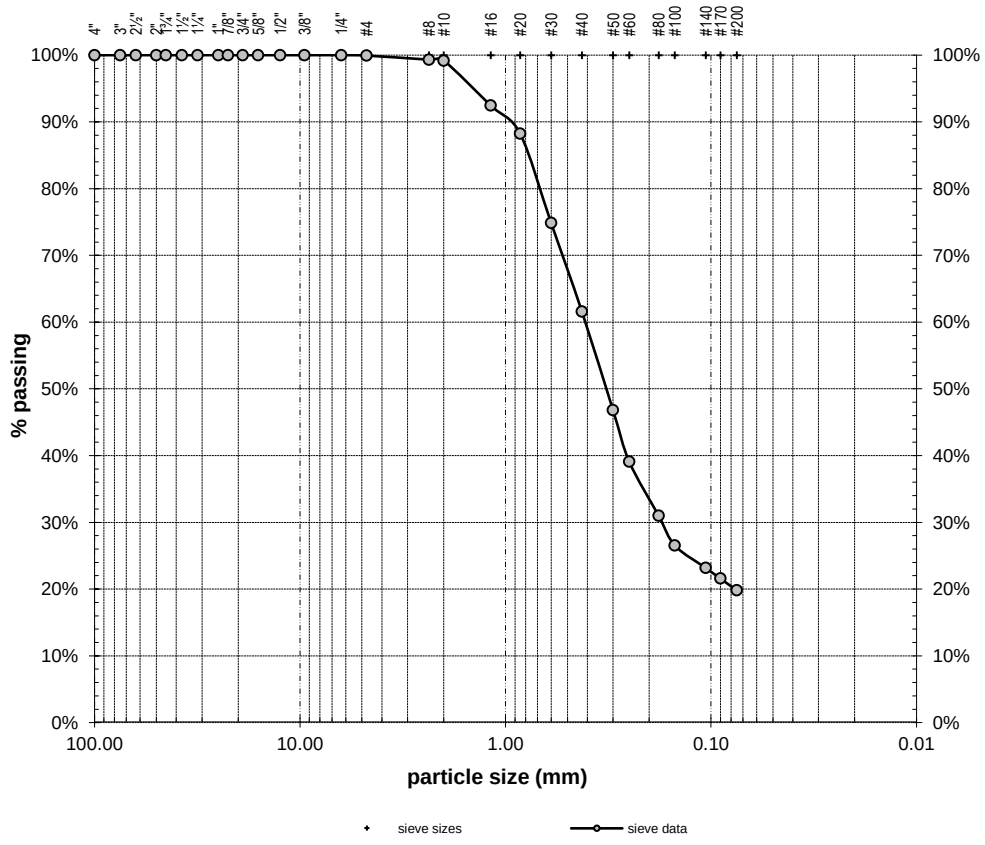
ADDITIONAL DATA

initial dry mass (g) =	151.9		
as-received moisture content =	42.6%	coefficient of curvature, C_C =	n/a
liquid limit =	43	coefficient of uniformity, C_U =	n/a
plastic limit =	25	effective size, $D_{(10)}$ =	n/a
plasticity index =	18	$D_{(30)}$ =	0.173 mm
fineness modulus =	n/a	$D_{(60)}$ =	0.410 mm

SIEVE DATA

% gravel = 0.1%
% sand = 80.1%
% silt and clay = 19.8%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30	100.0%			
	#4	4.75	99.9%			
SAND	#8	2.36		99.3%		
	#10	2.00	99.2%			
	#16	1.18		92.4%		
	#20	0.850	88.3%			
	#30	0.600		74.8%		
	#40	0.425	61.6%			
	#50	0.300		46.8%		
	#60	0.250	39.1%			
	#80	0.180		31.0%		
	#100	0.150	26.5%			
	#140	0.106		23.2%		
	#170	0.090		21.6%		
	#200	0.075	19.8%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-361
		REPORT DATE: 06/16/15	FIELD ID: TP8.2
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Clayey SAND	Test Pit TP-08 depth = 8 feet	SC, Clayey Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	43
plastic limit =	25
plasticity index =	18

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	39.55	37.83	35.98	
dry soil + pan weight, g =	33.98	32.70	31.23	
pan weight, g =	20.69	20.73	20.63	
N (blows) =	30	23	17	
moisture, % =	41.9 %	42.9 %	44.8 %	

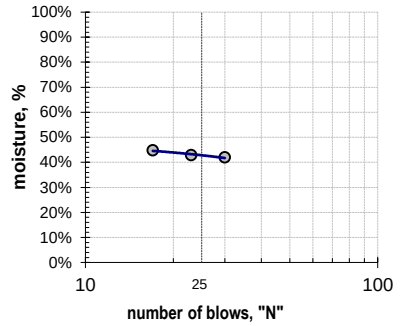
SHRINKAGE

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

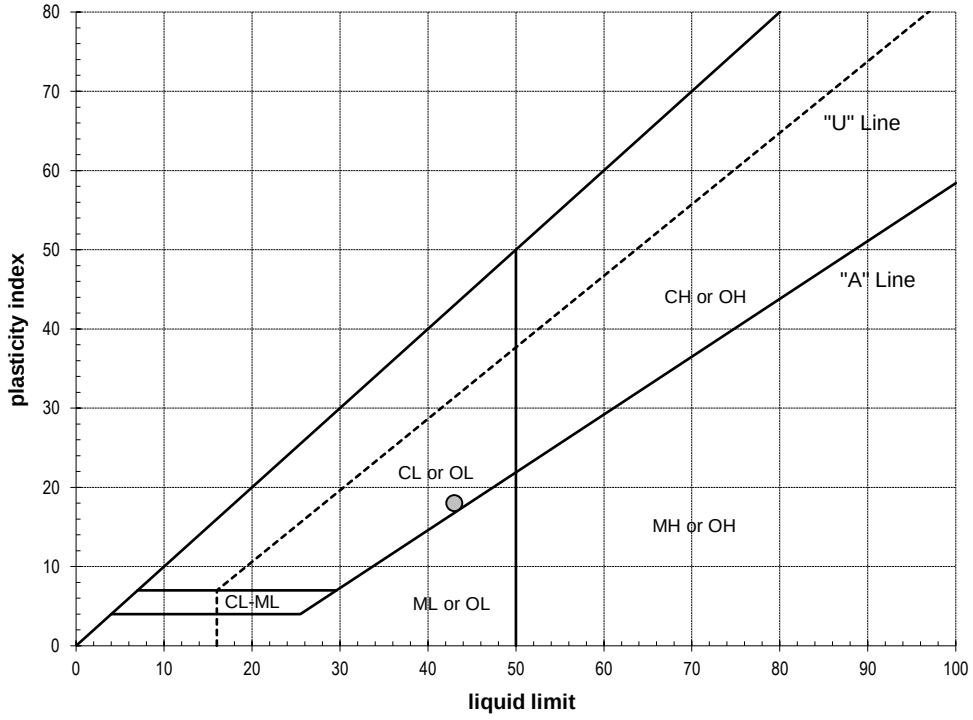
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.97	28.28		
dry soil + pan weight, g =	26.54	26.79		
pan weight, g =	20.74	20.77		
moisture, % =	24.7 %	24.8 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.1%
% sand =	80.1%
% silt and clay =	19.8%
% silt =	n/a
% clay =	n/a
moisture content =	42.6%

DATE TESTED	TESTED BY
06/15/15	MJR

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-362
		REPORT DATE 06/16/15	FIELD ID TP8.3
		DATE SAMPLED 06/04/15	SAMPLED BY HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded GRAVEL with Silt and Sand	Test Pit TP-08 depth = 12 feet	GP-GM, Poorly graded gravel with silt and sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-2-7(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

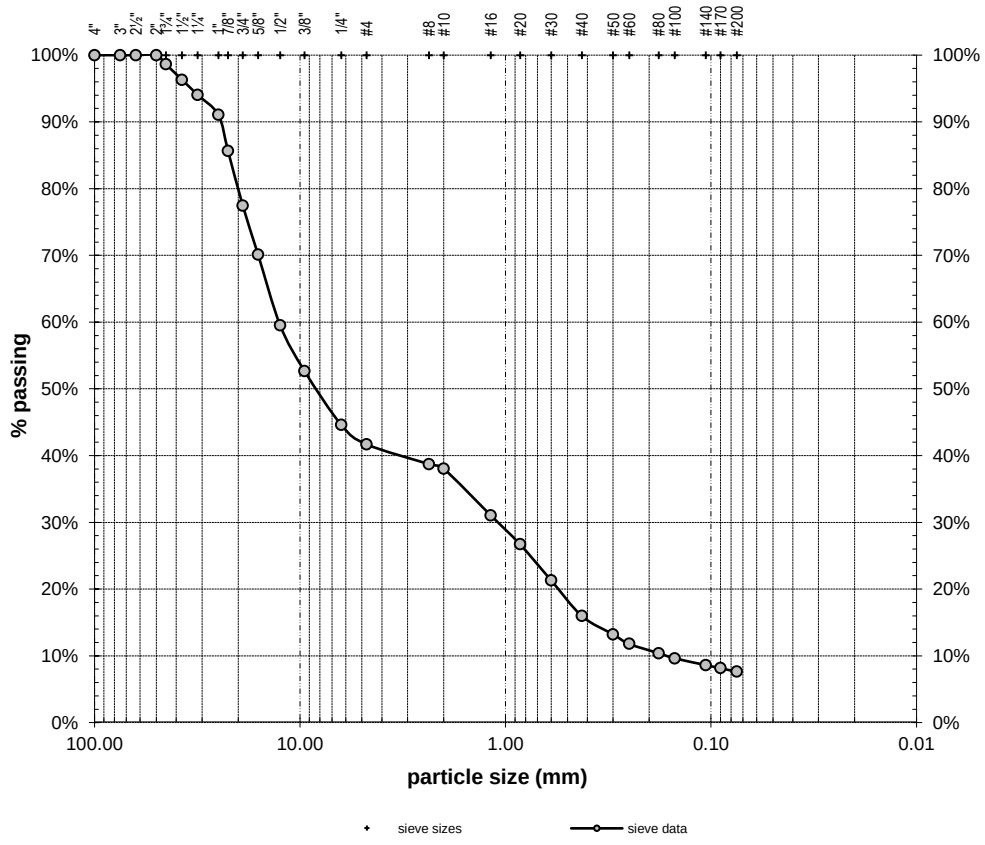
ADDITIONAL DATA

initial dry mass (g) =	3089.1		
as-received moisture content =	33.2%	coefficient of curvature, C_C =	0.57
liquid limit =	46	coefficient of uniformity, C_U =	76.93
plastic limit =	28	effective size, $D_{(10)}$ =	0.164 mm
plasticity index =	18	$D_{(30)}$ =	1.091 mm
fineness modulus =	n/a	$D_{(60)}$ =	12.637 mm

SIEVE DATA

% gravel = 58.3%
% sand = 34.1%
% silt and clay = 7.6%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0	100.0%			
	1.75"	45.0		98.6%		
	1.50"	37.5		96.3%		
	1.25"	31.5		94.0%		
	1.00"	25.0	91.1%			
	7/8"	22.4		85.6%		
	3/4"	19.0	77.5%			
	5/8"	16.0		70.1%		
	1/2"	12.5	59.5%			
	3/8"	9.50	52.6%			
	1/4"	6.30	44.6%			
	#4	4.75	41.7%			
SAND	#8	2.36		38.7%		
	#10	2.00	38.0%			
	#16	1.18		31.0%		
	#20	0.850	26.7%			
	#30	0.600		21.3%		
	#40	0.425	16.0%			
	#50	0.300		13.2%		
	#60	0.250	11.8%			
	#80	0.180		10.4%		
	#100	0.150	9.6%			
	#140	0.106		8.6%		
	#170	0.090		8.1%		
	#200	0.075	7.6%			

DATE TESTED	TESTED BY
06/08/15	BTT/MJR

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Parklands at Camas Meadows Camas, Washington	Mr. Aaron Barr & Mr. Kevin Deford Parklands at Camas Meadows, LLC PO Box 61962 Vancouver, WA 98666	15153	S15-362
		REPORT DATE: 06/16/15	FIELD ID: TP8.3
		DATE SAMPLED: 06/04/15	SAMPLED BY: HDG

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded GRAVEL with Silt and Sand	Test Pit TP-08 depth = 12 feet	GP-GM, Poorly graded gravel with silt and sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	46
plastic limit =	28
plasticity index =	18

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	39.57	37.55	37.51	
dry soil + pan weight, g =	33.76	32.29	32.08	
pan weight, g =	20.69	20.82	20.87	
N (blows) =	35	25	18	
moisture, % =	44.5 %	45.9 %	48.4 %	

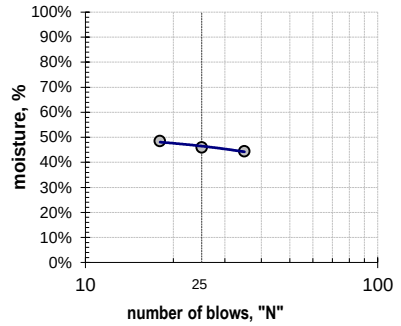
SHRINKAGE

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

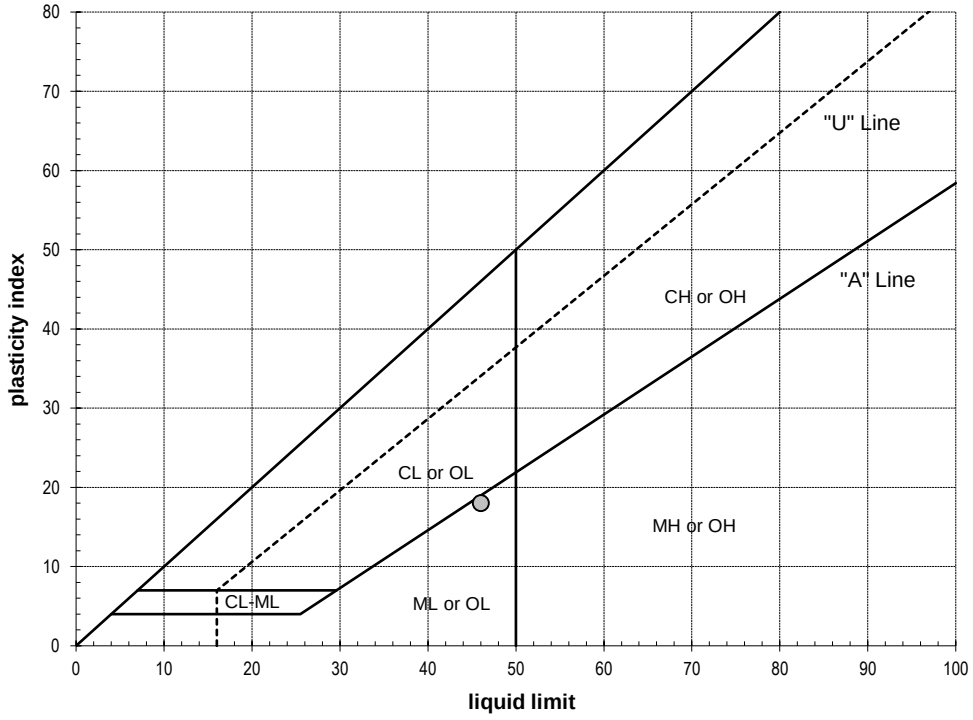
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.57	27.51		
dry soil + pan weight, g =	26.11	26.06		
pan weight, g =	20.82	20.80		
moisture, % =	27.6 %	27.6 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	58.3%
% sand =	34.1%
% silt and clay =	7.6%
% silt =	n/a
% clay =	n/a
moisture content =	33.2%

DATE TESTED	TESTED BY
06/15/15	MJR

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APPENDIX B
SUBSURFACE EXPLORATION LOGS

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-1
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	186	2.5 ft bgs	1030	1035

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 topsoil and root zone material.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated. Represents weathered conglomerate bedrock.					
						Difficult excavation. 6" to 8" weathered cobbles observed.					
						Refusal at 3.0 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.0 feet. Groundwater encountered at 2.5 feet.					
5											
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-2
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	190	Not encountered.	1000	1015

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 12 to 14 inches of topsoil and root zone material.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated. Represents weathered conglomerate bedrock. Difficult excavation. 6" to 8" weathered cobbles observed.					
5						Refusal at 3.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-3
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	208	Not encountered.	1115	1130

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 16 to 18 inches of topsoil and root zone material.					
	TP3.1		A-7-6(7)	CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.	36.4	57.1	44	16	
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation.					
5						Refusal at 4.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 4.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-4
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	214	Not encountered.	1150	1200

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 12 to 16 inches of topsoil and root zone material.					
				CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock.					
5						Refusal at 3.0 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.0 feet. Groundwater not encountered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-5
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	228	Not encountered.	1245	1255

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 12 to 14 inches of topsoil and root zone material.					
				CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation.					
5						Refusal at 4.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 4.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-6
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	210	Not encountered.	1215	1230

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 12 to 14 inches of topsoil and root zone material.					
	TP6.1		A-7-6(14)	CH		Brown sandy FAT CLAY, moist, medium stiff, fines are moderate to high plasticity.	32.3	62.6	51	25	
5				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation. 6" to 8" weathered cobbles observed.					
10						Refusal at 6.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 6.5 feet. Groundwater not encountered.					
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-7
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	218	Not encountered.	810	815

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 12 to 14 inches of topsoil and root zone material.					
				GP-GM		Poorly graded GRAVEL with silt and sand, dense, wet to saturated, gravels are rounded to subrounded. Represents weathered conglomerate bedrock. Difficult excavation. 6" to 8" weathered cobbles observed.					
5						Refusal at 3.5 feet, competent conglomerate bedrock encountered. Bottom of test pit at 3.5 feet. Groundwater not encoutered.					
10											
15											
20											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
The Parklands at Camas Meadows	Parklands, LLC		15153	TP-8
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
Camas, Washington		Excavator	HDG	6/4/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	210	Not encountered	830	900

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 16 to 18 inches of topsoil and root zone material.					
				CL		Brown sandy CLAY, moist, medium stiff, fines are medium plasticity.					
5											
	TP8.2		A-2-7(0)	SC		Light brown clayey SAND, moist, dense, lightly cemented, fines are medium plasticity. Difficult excavation.	42.6	19.8	43	18	
10											
	TP8.3		A-2-7(0)	GP-GM		Poorly graded GRAVEL with silt and sand, dense, saturated, gravels are subrounded to rounded. Groundwater seep.	33.2	7.6	46	18	
15						Refusal at 16.5 feet, competent conglomerate bedrock encountered.. Bottom of test pit at 16.5 feet. Groundwater encoutered at 15.5 feet.					
20											

APPENDIX C
SOIL CLASSIFICATION INFORMATION

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.

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 Percent or Less Passing .075 mm)				Silt-Clay Materials (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		

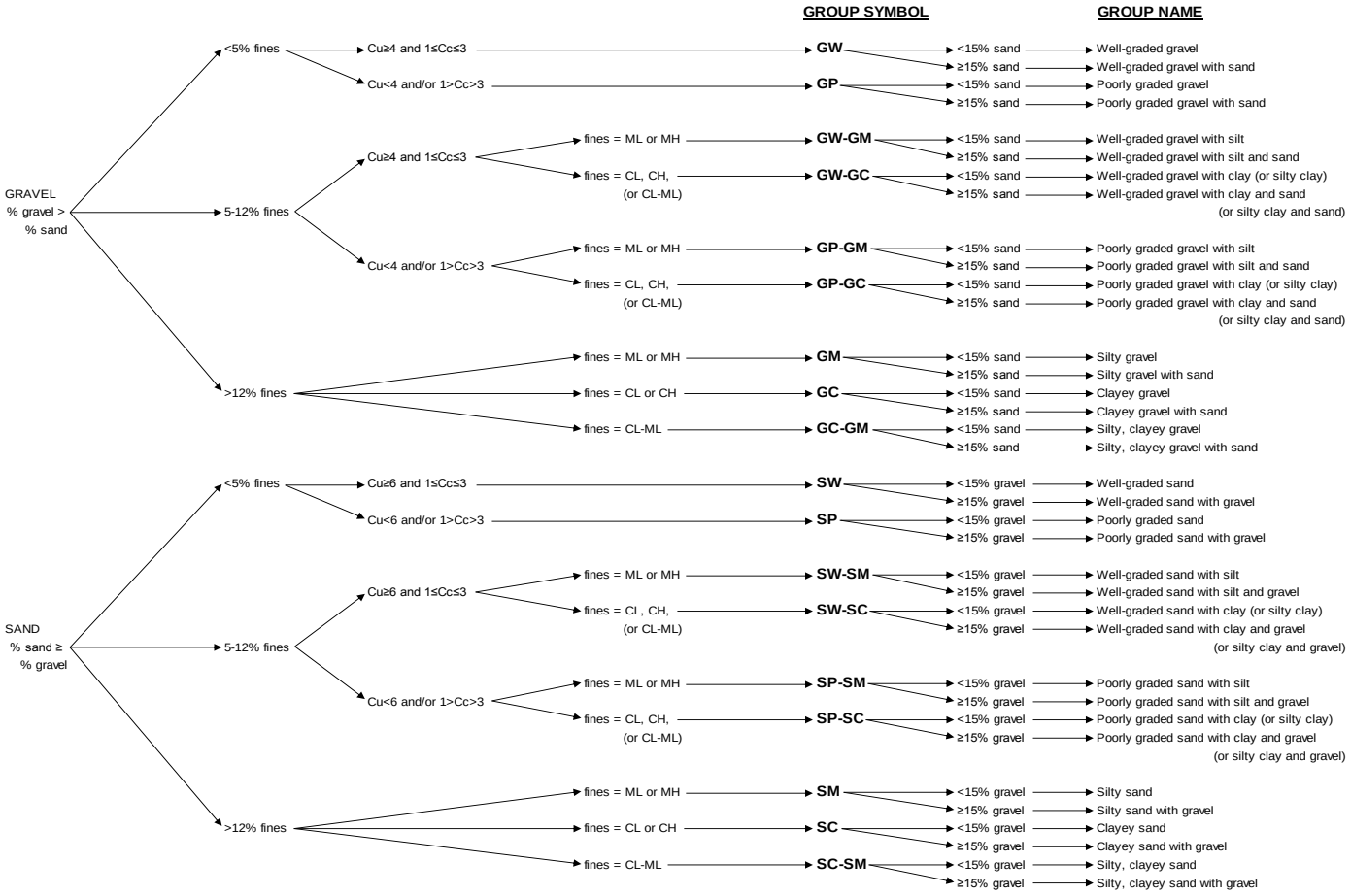
Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

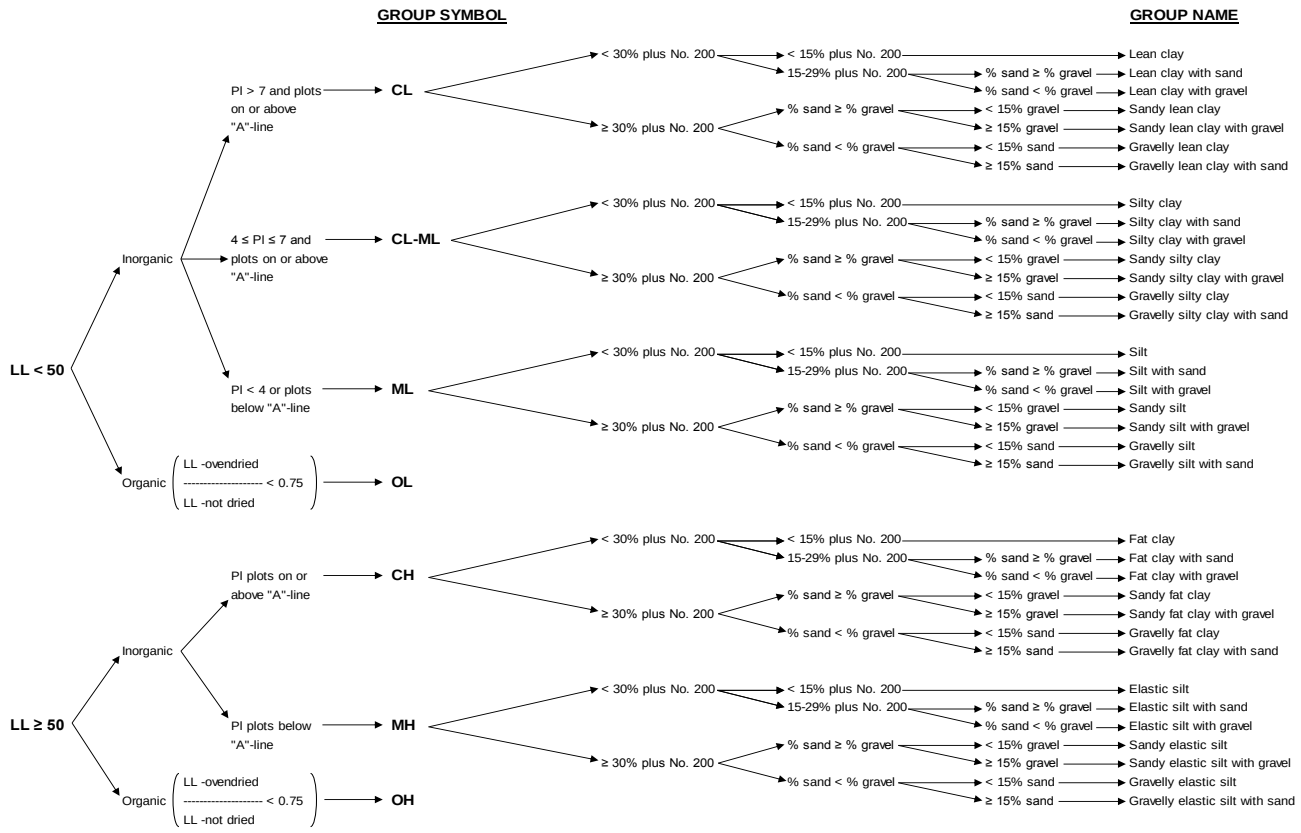
General Classification	Granular Materials (35 Percent or Less Passing 0.075 mm)							Silt-Clay Materials (More than 35 Percent Passing 0.075 mm)			
	A-1			A-2							A-7
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5, A-7-6
Sieve analysis, percent passing:											
2.00 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



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)

APPENDIX D
PHOTO LOG

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PHOTO LOG
Parklands at Camas Meadows
Camas, Washington



Shallow conglomerate bedrock in Test Pit TP-1



Shallow hyaoclastic sandstone bedrock in Test Pit TP-3



Shallow groundwater near Test Pit TP-1



Deeper conglomerate bedrock encountered in Test Pit TP-8

APPENDIX E
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

Date: June 23, 2015
Project: Parklands at Camas Meadows
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

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.

Final Wetland Delineation Report
for

Parklands at Camas Meadows
Camas, Washington

Prepared for:

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Preliminary Draft August 2015
Interim Draft November 2015
Final Report December 2015 w/ Final Wetland Rating Summary
ELS Project #2255.01

SIGNATURES

The information and data in this report were compiled and prepared under the supervision and direction of the undersigned.

Timothy Haderly
Principal/Ecologist

Rachel Allison
Biologist

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INTRODUCTION

Ecological Land Services, Inc. (ELS) has completed a wetland delineation for Parklands at Camas, LLC on NW 218th Avenue, in Camas, Washington. The study area consists of Tax Parcels 175948-000 and 986031-650, and is located in Section 28, Township 2 North, Range 3 East, of the Willamette Meridian in the City of Camas Water Resources Inventory Area 28 (Figure 1). This report summarizes the findings of the wetland determination according to the *City of Camas Municipal Code (CMC) Chapter16.53 – Wetlands.*

METHODOLOGY

ELS conducted a site visit on April 28, 2015 to delineate the onsite critical areas, assess wetland functions, and gather vegetation, soils, and hydrology data within the study area. Wetlands were delineated onsite with consecutively numbered wetland boundary flagging. The wetland boundaries were primarily determined by topographical changes and the presence of hydric soils, hydrology, and hydrophytic vegetation. Vegetation, soil, and hydrology data were collected from seven test plots within the study area to verify the presence and boundaries of the wetlands (Figure 2 and Appendix A). Soil colors in test plots were evaluated by hue, value, and chroma using the Munsell Soil Color Chart (Munsell 2000).

Wetlands A, B and C were delineated using the Routine Determination Method according to the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987), the *Final Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010). The Routine Determination Method examines vegetation, hydrology, and soils to determine if wetlands exist in a given area. The presence of hydrology is critical in determining what qualifies as a wetland; however, since hydrologic conditions can change periodically (hourly, daily, or seasonally) it is necessary to determine if hydrophytic vegetation and hydric soils exist, indicating water is present long enough to support a wetland plant community. By definition, wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands are regulated by the United States Army Corps of Engineers (Corps) as "Waters of the United States," by the Washington State Department of Ecology (Ecology) as "Waters of the State," and locally by the *City of Camas Municipal Code (CMC) Chapter 16.53 - Wetlands.*

SITE DESCRIPTION

The approximate 36-acre study area consists of mainly deciduous and coniferous forested wetlands, with small areas of forested upland hummocks interspersed. The area slopes gently to the northwest and currently there are no buildings or structures located in the study area.

Area surrounding the parcels consists of residential housing developments to the southeast, private land use (pasture) and private single-family residences to the southwest, open grassland

and a golf course to the northwest and northeast, with Lacamas Creek and Lacamas Lake on the other side of the golf course. The property is accessed from NW Camas Meadows Drive and NW Payne Street, along the western property boundary.

SOILS

The soils within the study area are mapped as Cove silty clay loam, 0 to 3 percent slopes (CvA), Hesson clay loam, 0 to 8 percent slopes (HcB), Hesson clay loam, 8 to 20 percent slopes (HcD), Hesson clay loam, 20 to 30 percent slopes (HcE), and Lauren gravelly loam, 0 to 8 percent slopes (LgB) (Figure 3).

Cove silty clay loam soil is found in concave drainage ways and in large, flat, old lakebeds. The slope is generally less than 1 percent. In a typical profile the surface layer is very dark gray silty clay loam about 4 inches thick. Below this is firm clay about 32 inches thick. Surface runoff is very slow, and ponding is common in winter unless drainage is provided. The Cove series consists of deep, poorly drained, mostly nearly level soils. The Hesson clay loam series soils are generally found on terraces and are formed from alluvium. The slopes range from 0 to 30 percent. In typical profiles, Hesson clay loams consist of clay loam from 0 to 12 inches below ground surface (BGS) and clay from 12 to 60 inches BGS. Hesson clay loam (HcE) differs slightly, in that a typical profile consists of clay loam from 0 to 9 inches BGS, and clay from 9 to 60 inches BGS. This soil series is well drained and has a very low tendency, to no tendency of ponding. Lauren gravelly loam is found on terraces and is formed from alluvium with volcanic ash. In a typical profile, the surface layer is gravelly medial loam from 0 to 6 inches, very gravelly medial loam from 6 to 33 inches, very gravelly coarse sandy loam from 33 to 44 inches, and very gravelly loamy coarse sand from 44 to 60 inches BGS. This soil is somewhat excessively drained, and has a very low tendency, to no tendency of ponding.

Cove silty clay loam is listed as a hydric soil on the *Washington State Hydric Soils List* (NRCS 2014). The presence or absence of hydric soil does not conclude that an area is wetland or upland; along with hydric soils, hydrology and wetland vegetation must also be present to determine an area as jurisdictional wetland. Because of localized, micro-variations in topography and hydrology, wetlands may be found in areas where hydric soils have not been mapped by the soil survey.

Site evaluated wetland soils generally ranged from very dark brown (10YR 2/2) clay to black (10YR 2/1) and dark gray (10YR 4/1) silty clay loams exhibiting redoximorphic features of dark yellowish brown (10YR 3/6) and dark red (2.5YR 3/6). The wetland soils were generally consistent with the mapped soil types, as the wetland generally follows the mapped Cove silty clay loam from the NRCS.

Site evaluated upland soils generally consisted of dark brown (10YR 3/3) silt loams and clays, and exhibited no redoximorphic features. The upland soils were generally consistent with the mapped soil types bordering Cove silty clay loam, as mapped by the NRCS.

VEGETATION

Wetlands

Dominant hydrophytic vegetation within the wetland areas onsite includes Oregon ash (*Fraxinus latifolia*, FACW), bigleaf maple (*Acer macrophyllum*, FACU), red alder (*Alnus rubra*, FAC), vine maple (*Acer circinatum*, FAC), red-osier dogwood (*Cornus sericea*, FACW), Douglas spiraea (*Spiraea douglasii*, FACW), salmonberry (*Rubus spectabilis*, FAC), California false hellebore (*Veratrum californicum,* FAC), water parsley (*Oenanthe sarmentosa*, OBL), reed canarygrass (*Phalaris arundinacea*, FACW), and skunk cabbage (*Symplocarpus foetidus*, OBL).

Uplands

Dominant vegetation within the upland areas onsite includes bigleaf maple, western redcedar (*Thuja plicata*, FAC), Douglas fir (*Pseudotsuga menziesii*, FACU), non-native cedar species (NI), saxifrage species (NI), Himalayan blackberry (*Rubus armeniacus*, FACU), trailing blackberry (*Rubus ursinus*, FACU), sword fern (*Polystichum munitum*, FACU), oceanspray (*Holodiscus discolor,* FACU), beaked hazelnut (*Corylus cornuta*, FACU), Indian plum (*Oemleria cerasiformis*, FACU), and threepetal bedstraw (*Galium trifidum*, FACW).

The dominant species of vegetation in each test plot have been recorded on the attached wetland delineation data sheets (Appendix A). The indicator categories following the common and scientific names indicate the likelihood of a species to be found in wetlands. Listed from most-likely to least-likely to be found in wetlands, the indicator categories are:

- **OBL** (obligate wetland) – Almost always occur in wetlands.
- **FACW** (facultative wetland) – Usually occur in wetlands, but may occur in non-wetlands.
- **FAC** (facultative) – Occur in wetlands and non-wetlands.
- **FACU** (facultative upland) – Usually occur in non-wetlands, but may occur in wetlands.
- **UPL** (obligate upland) – Almost never occur in wetlands.
- **NI** (no indicator) – Status not yet determined.

HYDROLOGY

Wetlands A,B, and C are hydrologically influenced primarily by precipitation (including stormwater discharge) and secondarily by a high groundwater table; hydrology into Wetlands A, B, and C can be attributed primarily to precipitation, but also from stormwater runoff from surrounding housing developments, agricultural land use, and golf courses. Wetland C is mostly hydrologically influenced by precipitation, but stormwater runoff from the housing development located directly to the southeast can be an attributing factor as well. Cumulative water flow within all wetlands follows a northwest trend, following the topography of the study area. Wetlands A, B, and C are depressional wetlands, with Wetland A and B occurring throughout the northern portion of the study area, and Wetland B occurring along the eastern border of the northern portion (Figure 2). Both wetlands have highly constricted outlets.

WETLANDS INVENTORY

National Wetlands Inventory

The U.S. Fish and Wildlife Service's National Wetlands Inventory (2014; NWI) map indicates the presence of a PFOA[1] wetland within the northern portion of the study area (Figure 4). A R2UBH[2] water body (Lacamas Lake) is mapped directly to the northeast of the study area. ELS agrees with the NWI, as two depressional, forested wetlands were delineated in generally the same location as the NWI mapped wetland.

Clark County Critical Areas

The Clark County Critical Areas (CCCA) (Figure 5) map indicates no presence of wetlands or other critical areas within the study boundary. The CCCA map does however; indicate the presence of a water body (Lacamas Lake) to the northeast, and not within the confines of the study area. ELS does not agree with the CCCA map, as a depressional, forested wetland was delineated in the northern portion of the study area.

NWI and CCCA maps are typically used to gather wetland information about a region and, because of the large scale necessary for regional mapping, are limited in accuracy for localized analyses.

CONCLUSIONS

WETLANDS

ELS staff delineated Wetlands A, B, and C within the study area encompassing Tax Parcels 175948-000 and 986031-650 on April 28, 2015 (Figure 2). All three wetlands are hydrologically connected through culverts observed onsite and locations mapped with a GPS unit and therefore were rated as one wetland unit according to the Ecology's *Wetland Rating Form (Rating Form) for Western Washington-Revised* (Hruby 2014). The wetland unit is a non-tidal, freshwater, palustrine depressional wetland and supports both emergent and forested vegetation. The outlet for the wetland unit is unconstricted and permanently flowing, so long as hydrology is present and in sufficient quantity to maintain flows periods. When inundation is present, water depths range from 6 to 20 inches. Hydrologic functions may consist of some water retention on surface depressions during high flow events. Overall, drainage is slow in the wetland, but flow does eventually and directly reach Lacamas Lake.

The wetland unit is considered to have low to moderate habitat potential onsite based on the plant community's interspersion and species richness (presence and diversity of emergent, scrub-shrub, and forested vegetation), a landscape that supports multiple hydroperiods (seasonal inundation, occasional inundation, and saturation), and the presence of "special habitat features".[3] Accessibility of habitat provided by the wetland unit to other wetlands or forested

[1] **P**=palustrine, **FO**=forested, **A**=temporarily flooded
[2] **R**=riverine, **2**=lower perennial, **UB**=unconsolidated bottom, **H**=permanently flooded
[3] "…certain habitat features in a wetland provide refuge and resources for many different species. The presence of these features increases the potential that a given wetland will provide a wide range of habitats" (Hruby, 2014)

area in the local vicinity is limited by adjacent residential, commercial, and agricultural land uses. Somewhat undisturbed connectivity between the wetland unit and Lacamas Lake can be seen from aerial photography: a narrow band of relatively unmanaged vegetation (Figure 7). With consideration of the adjacent and management practices and limited connectivity, the wetland unit provides low habitat value despite being a relatively well-developed forested wetland system. Foraging opportunities are available for small mammals, common resident and migratory song birds, and birds of prey. Larger mammals, such as deer, coyotes, raccoons, and other transitory species accustomed to urbanized or developed conditions may use the wetland for short-term refuge, grazing, or hunting. There was no evidence (browse, rubs, tracks, etc.) observed by ELS during the onsite wetland assessments.

Wetland Categorization and Buffer Requirements

The wetland unit was categorized according to CMC using the Department of Ecology *Washington State Wetland Rating System for Western Washington, Revised* (Hruby, 2014). Wetlands A, B, and C are Category III wetlands. Buffer widths are based on wetland category, wetland characteristics, and land use intensity (CMC 16.53.040(b)). In this case, the proposed land use activity is a residential subdivision, a structure that meets the criteria for high land use intensity (CMC 16.53.040-4). Category III wetlands with a habitat score of 5 and a high land use intensity proposal receive a designated buffer width of one hundred twenty feet (CMC 16.53.040-4 and Table 1).

Table 1. *Summary of Critical Areas On-site.*

Wetland	Hydrogeomorphic Classification	Cowardin[1] Class	Area (acres onsite)	Category[2]	Starting Buffer Width[3] (feet)	Mitigated Buffer Width[4] (feet)
Wetland A	Depressional	Forested	5.90	III	120	50
Wetland B	Depressional	Forested	1.33	III	120	50
Wetland C	Depressional	Forested	0.12	III	120	50

[1]Cowardin *et al.* 1979
[2]Ecology *Rating Form* (Hruby 2014).
[3] According to CMC Table 16.53.040-3
[4] According to CMC 16.53.050(C)(1)(c)

BUFFER WIDTH REDUCTION JUSTIFICATION NARRATIVE

This narrative addresses the process used to establish buffers on wetlands at the Parklands at Camas Meadows project near the Camas Meadows Golf Course. Parklands at Camas is a mixed use development including 42 single-family residential lots with an adjacent professional business park consisting of four or five buildings of varying size.

Wetland buffers at the proposed Parklands at Camas Meadows project are required according to Camas Municipal Code (CMC) Chapter 16.53 – WETLANDS. The wetlands at Parklands at Camas Meadows are Category III wetlands based on the 2014 Wetland Rating System for Western Washington.

The applicant is proposing a 50-foot wide buffer based on CMC 16.53.050(C)(1)(c) *Combined Reductions. Buffer width reductions allowed under subsections (C)(1)(a) and (C)(1)(b) of this section may be added provided that minimum buffer widths shall never..., or less than fifty feet for Category III wetlands,...*

CMC 16.53.050(C)(1)(a)(i) requires a 100 foot wide relatively undisturbed, vegetated corridor between the wetland and any other priority habitats. Given the configuration of the subject site, the fact that the property to the north is controlled by another entity (golf course), and the Priority Habitat is more than 1,000 feet away; this section is not applicable to the wetland buffer requirements on the subject site.

CMC 16.53.050(C)(1)(a)(ii) requires measures to minimize impacts to the land adjacent to the wetland to help reduce impacts to the wetland. The project applicants have agreed to implement the following measures to assure the on-site wetland is protected from the proposed adjacent developments:

1. CCR's will be written, recorded, and enforced as applicable to uses within and adjacent to wetlands and buffers.
2. Storm water from streets and traffic bearing surfaces will be collected, treated, and conveyed in facilities outside of the from wetlands and the associated buffers. The wetlands and buffers will **NOT be used for storm water treatment or detention/retention facilities.**
3. Native vegetation and soils will be retained in the wetland buffer areas.
4. Outdoor lighting will be designed to reduce the encroachment of light into the resource area. Use of green LED low watt bulbs and shielding will be encouraged.
5. Noise will be controlled by implementing an evening curfew quiet time period. All fireworks and other noise making devices will be strictly prohibited.
6. Wetland buffers will be demarcated be erecting black wrought iron or similar fencing with an open spacing design.
7. No personal gates will be allowed from back yards into the wetland buffer area.
8. Fertilizers, pesticides, and herbicides use in back yards will be discouraged.
9. Backyard landscaping will be focused on using native trees, shrubs, and ground covers to increase habitat and reduce to need for chemicals and irrigation.
10. Informational signage will be installed along the outer edge of the wetland buffer to further demarcate the resource area.

CMC 16.53.050(C)(1)(b) requires a 100 foot wide relatively undisturbed, vegetated corridor between the wetland and any other priority habitats. Given the configuration of the subject site, the fact that the property to the north is controlled by another entity (golf course), and the Priority Habitat is more than 1,000 feet away; this section is not applicable to the wetland buffer requirements on the subject site.

It is our opinion that a 50-foot wide buffer on the Category III wetland at the Parklands at Camas project site (1) meets the code requirements of CMC Chapter 16.53 and (2) will adequately protect the wetland from proposed developments at the site. With proper enhancements and protections outlined previously, we believe that a 50-foot wide buffer will provide functions equal to or greater than the standard 120-foot wide buffer.

LIMITATIONS

ELS personnel base the conclusions contained within this report on standard scientific methodology and best professional judgment. In our opinion, local, state, and federal regulatory agencies should agree with the findings presented in this report.

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. There are no other warranties, express or implied. The services preformed were consistent with our agreement with our client. This report is prepared solely for the use of our client and may not be used or relied upon by a third party for any purpose. Any such use or reliance will be at such party's risk.

The opinions and recommendations contained in this report apply to conditions existing when services were performed. ELS is not responsible for the impacts of any changes in environmental standards, practices, or regulations after the date of this report. ELS does not warrant the accuracy of supplemental information incorporated in this report that was supplied by others.

REFERENCES

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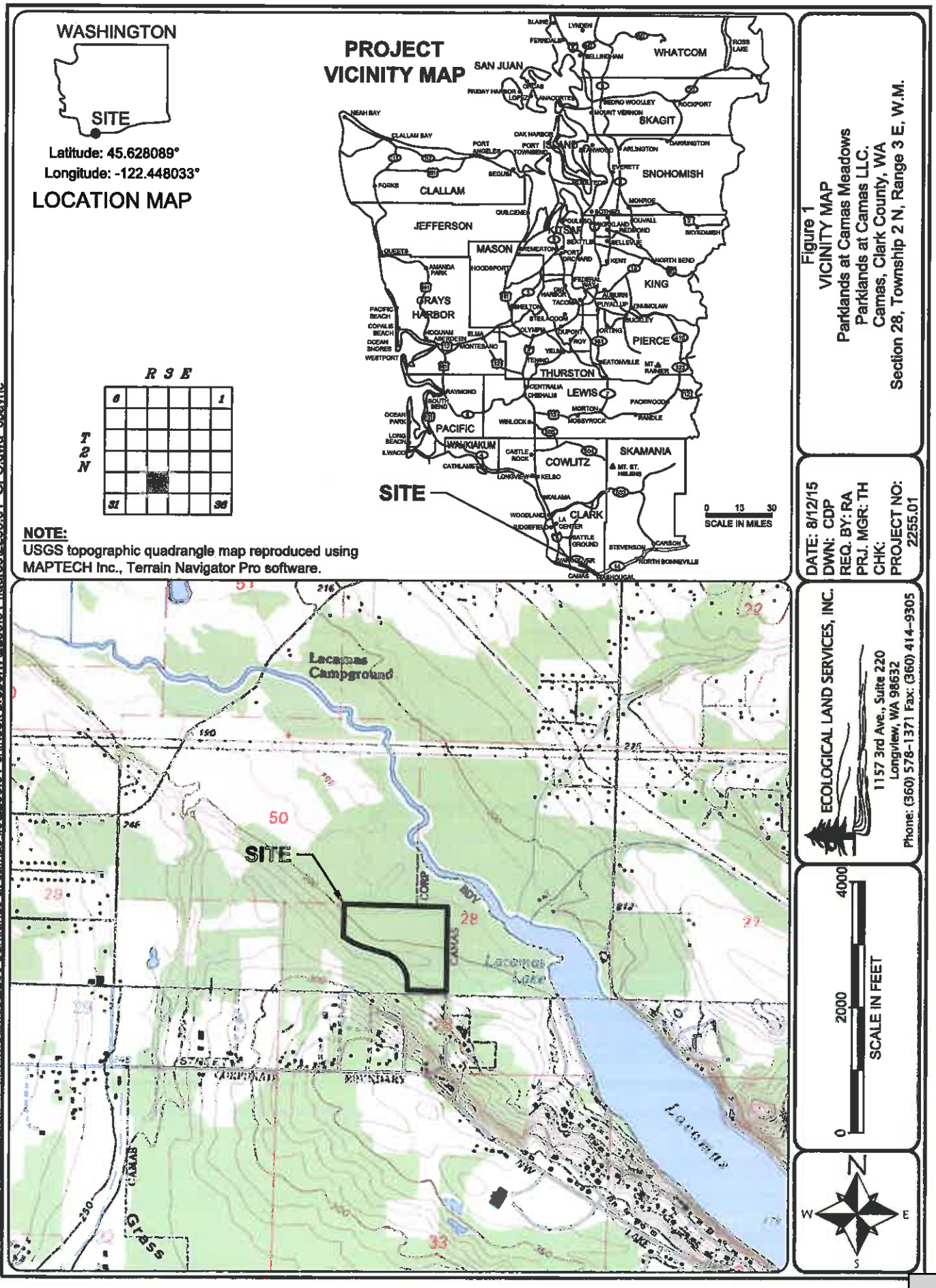
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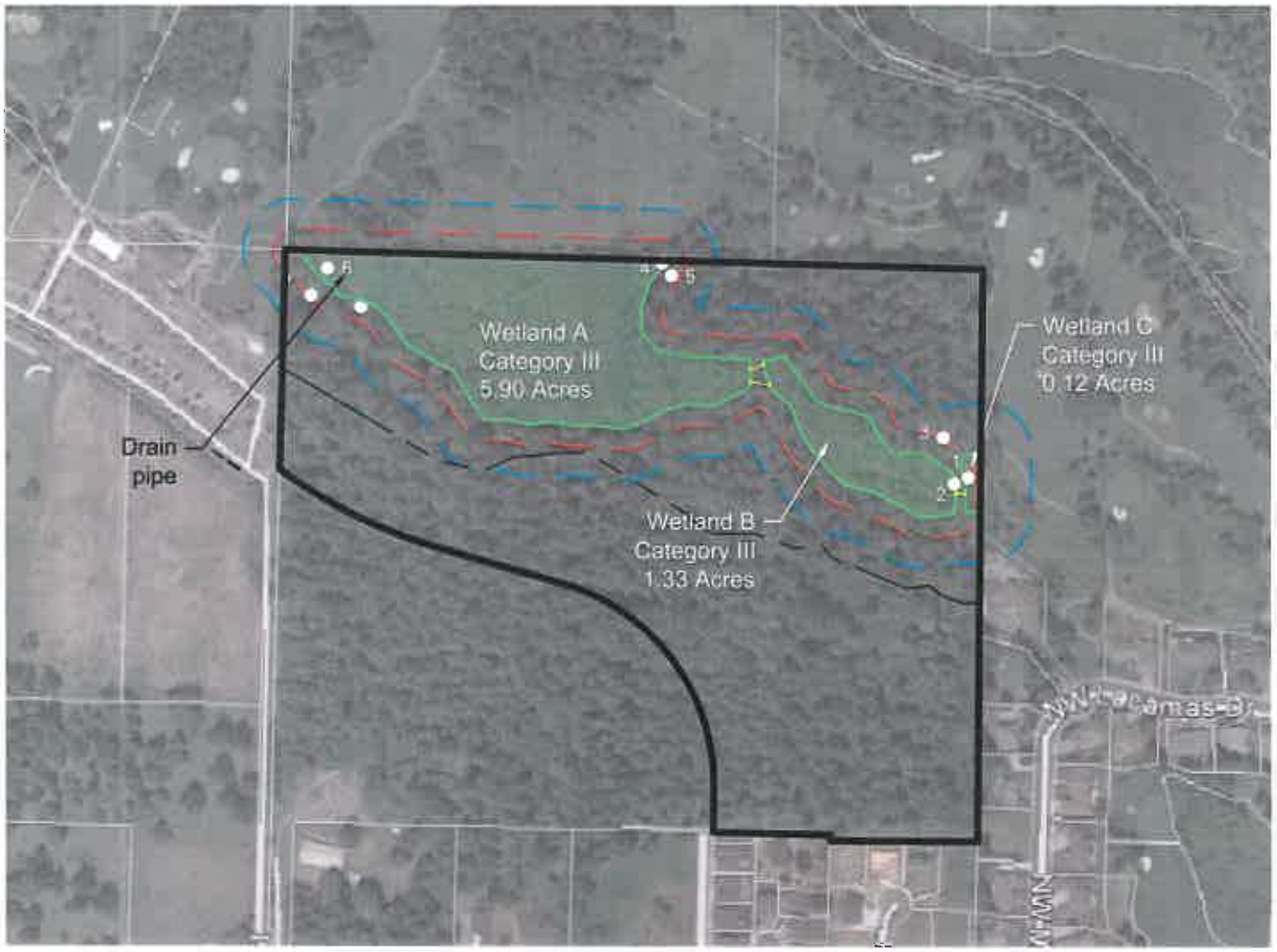
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FIGURES



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LEGEND:

- Site Boundary
- Wetland
- 120' Buffer
- 50' Reduced Buffer
- 1 ● Test Plot Location
- Culvert
- Parcel Boundary

NOTE(S):

1. Base map from ***Google Earth.***™

N W E S

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SCALE IN FEET

ECOLOGICAL LAND SERVICES, INC.
1157 3rd Ave., Suite 220
Longview, WA 98632
Phone: (360) 578-1371 Fax: (360) 414-9305

DATE: 8/12/15
DWN: CDP
REQ. BY: RA
PRJ. MGR: TH
CHK:
PROJECT NO: 2255.01

Figure 2
SITE MAP
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

Exhibit 16 SP26-1005



Figure 3
SOIL SURVEY MAP
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

DATE: 8/12/15
DWN: CDP
REQ. BY: RA
PRJ. MGR: TH
CHK:
PROJECT NO: 2255.01

ECOLOGICAL LAND SERVICES, INC.
1157 3rd Ave., Suite 220
Longview, WA 98632
Phone: (360) 578-1371 Fax: (360) 414-9305

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LEGEND:

CvA	Cove silty clay loam, 0 to 3 percent slopes. **Hydric**.
HcD	Hesson clay loam, 8 to 20 percent slopes. Not hydric.
HcB	Hesson clay loam, 0 to 8 percent slopes. Not hydric.
HcE	Hesson clay loam, 20 to 30 percent slopes. Not hydric.
LgB	Lauren gravelly loam, 0 to 8 percent slopes. Not hydric.

NOTE(S):

1. Map provided on-line by NRCS at web address: *http://websoilsurvey.nrcs.usda.gov/app/*

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Figure 4
NATIONAL WETLANDS INVENTORY MAP
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

DATE: 8/12/15
DWN: CDP
REQ. BY: RA
PRJ. MGR: TH
CHK:
PROJECT NO: 2255.01

ECOLOGICAL LAND SERVICES, INC.
1157 3rd Ave., Suite 220
Longview, WA 98632
Phone: (360) 578-1371 Fax: (360) 414-9305

0 400 800
SCALE IN FEET

N
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S

Wetlands indicated onsite by US Fish & Wildlife Service.

LEGEND:

- Freshwater Forested/Shrub Wetland
- Riverine

R2UBH Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded.
PFOA Palustrine, forested, temporarily flooded.

NOTE(S):

1. Map provided on-line by US Fish & Wildlife Service at web address: *http://www.fws.gov/wetlands/data/index.html*

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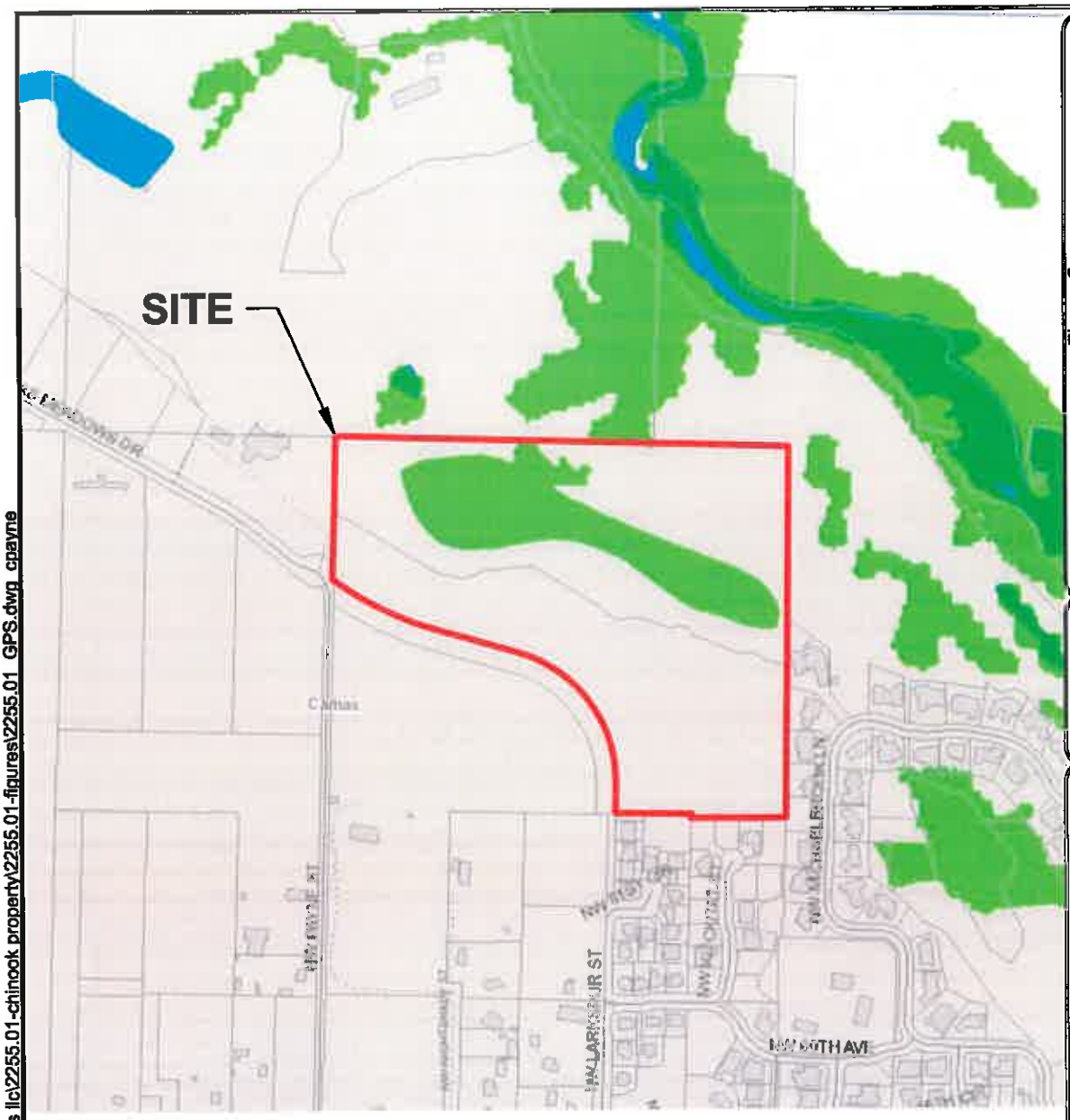


Figure 5
CLARK COUNTY CRITICAL AREAS
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

DATE: 8/12/15
DWN: CDP
REQ. BY: RA
PRJ. MGR: TH
CHK:
PROJECT NO: 2255.01

ECOLOGICAL LAND SERVICES, INC.
1157 3rd Ave., Suite 220
Longview, WA 98632
Phone: (360) 578-1371 Fax: (360) 414-9305

0 600 1200
SCALE IN FEET

N
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Wetlands indicated onsite by Clark County.

LEGEND:

Site Boundary

NOTE: Map provided on-line by Clark County, Washington at web address: *http://gis.clark.wa.gov/imf/imf.jsp?site=zoning*
This map combines NWI, mapped, permit and modeled wetlands in a single class. Identical to WETINV, except lacking its attribute data. Also excludes any of the modeled wetlands that were field verified to not possess wetland characteristics.

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APPENDIX A- WETLAND DETERMINATION DATA FORMS

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/2015
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-1
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: Concave Slope (%): 20-30%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: HcE NWI classification: PFOA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☐ No☒
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** Yes☒ No☐
Hydric Soils Present?	Yes ☐	No ☒	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks: Although hydric soils are not present, TP-1 is determined to be within a wetland due to a strong presence of hydrophytic vegetation and wetland hydrology indicators.

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus latifolia*	20%	yes	FACW
2.	%		
3.	%		
4.	%		
Total Cover:	20%		
Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1. *Spiraea douglasii*	70%	yes	FACW
2. *Cornus sericea*	30%	yes	FACW
3.	%		
4.	%		
5.	%		
Total Cover:	100%		
Herb Stratum (Plot size: 5 ft radius)			
1. *Symplocarpus foetidu*	30%	yes	OBL
2. *Phalaris arundinacea*	10%	yes	FACW
3.	%		
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	40%		
Woody Vine Stratum (Plot size: 30 ft radius)			
1.	%		
2.	%		
Total Cover:	%		

% Bare Ground in Herb Stratum 60%

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC _____ (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1=	
FACW species		x 2=	
FAC species		x 3=	
FACU species		x 4=	
UPL species		x 5=	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☒ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☒ No☐

Remarks:

SOIL

Sampling Point: TP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/2	100%		%			Clay	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: ____

Depth (inches):

Hydric Soil Present? Yes☐ No☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ **Surface Soil Cracks (B6)**
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ **Other (Explain in Remarks)**
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (Inches):
Water Table Present?	Yes ☒	No ☐	Depth (Inches): 0
Saturation Present? (Includes Capillary fringe)	Yes ☒	No ☐	Depth (Inches): 0

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/2015
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-2
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: Concave Slope (%): 0-3%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: CvA NWI classification: PFOA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☐ No☒
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** Yes☒ No☐
Hydric Soils Present?	Yes ☐	No ☒	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks: Although hydric soils are not present, TP-1 is determined to be within a wetland due to a strong presence of hydrophytic vegetation and wetland hydrology indicators.

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus latifolia*	20%	yes	FACW
2. *Alnus rubra*	20%	yes	FACW
3.	%		
4.	%		
Total Cover:	40%		

Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1. *Acer circinatum*	30%	yes	FAC
2. *Spiraea douglasii*	20%	yes	FACW
3.	%		
4.	%		
5.	%		
Total Cover:	50%		

Herb Stratum (Plot size: 5 ft radius)			
1. *Symplocarpus foetidus*	80%	yes	OBL
2. *Oenanthe sarmentosa*	15%	no	OBL
3. *Athyrium felix-femina*	5%	no	FAC
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	100%		

Woody Vine Stratum (Plot size: 30 ft radius)			
1.	%		
2.	%		
Total Cover:	%		

% Bare Ground in Herb Stratum %

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1=	
FACW species		x 2=	
FAC species		x 3=	
FACU species		x 4=	
UPL species		x 5=	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☒ No☐

Remarks:

SOIL

Sampling Point: TP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/2	%		%			Clay	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: ____

Depth (inches):

Hydric Soil Present? Yes☐ No☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (Inches):
Water Table Present?	Yes ☒	No ☐	Depth (Inches): 0
Saturation Present? (Includes Capillary fringe)	Yes ☒	No ☐	Depth (Inches): 0

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/2015
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-3
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: None Slope (%): 0-3%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: CvA NWI classification: PFOA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☒ No☐
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes☐ No☒
Hydric Soils Present?	Yes ☐ No ☒	
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks:

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	20%	yes	FAC
2. *Pseudotsuga menziesii*	20%	yes	FACU
3.	%		
4.	%		
Total Cover:	40%		
Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1. ***Symphoricarpos albus***	**15%**	**yes**	FACU
2. *Holodiscus discolor*	15%	yes	FACU
3. *Gaultheria shallon*	15%	yes	FACU
4. Rubus parviflorus	15%	yes	FAC
5.	%	yes	FACU
Total Cover:	60%		
Herb Stratum (Plot size: 5 ft radius)			
1.	%		
2.	%		
3.	%		
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	%		
Woody Vine Stratum (Plot size: 30 ft radius)			
1. *Rubus armeniacus*	40%	yes	FACU
2.	%		
Total Cover:	40%		

% Bare Ground in Herb Stratum %

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC 13 (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1=	
FACW species		x 2=	
FAC species		x 3=	
FACU species		x 4=	
UPL species		x 5=	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☐ No☒

Remarks:

SOIL

Sampling Point: TP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/3	100%		%			Clay	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: ____

Depth (inches):

Hydric Soil Present? Yes☐ No☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (Inches):
Water Table Present?	Yes ☐	No ☒	Depth (Inches):
Saturation Present? (Includes Capillary fringe)	Yes ☐	No ☒	Depth (Inches):

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/15
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-4
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: Concave Slope (%): 0-3%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: CvA NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☒ No☐
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** Yes☒ No☐
Hydric Soils Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks:

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus latifolia*	30%	yes	FACW
2. *Alnus rubra*	20%	yes	FAC
3.	%		
4.	%		
Total Cover:	50%		
Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1. *Cornus sericea*	20%	yes	FACW
2. *Rubus spectabilis*	15%	yes	FAC
3.	%		
4.	%		
5.	%		
Total Cover:	35%		
Herb Stratum (Plot size: 5 ft radius)			
1. *Oenanthe sarmentosa*	40%	yes	OBL
2. *Symplocarpus foetidus*	30%	yes	OBL
3. *Phalaris arundinacea*	30%	yes	FACW
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	100%		
Woody Vine Stratum (Plot size: 5 ft radius)			
1.	%		
2.	%		
Total Cover:	%		

% Bare Ground in Herb Stratum %

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1=	
FACW species		x 2=	
FAC species		x 3=	
FACU species		x 4=	
UPL species		x 5=	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☒ No☐

Remarks:

SOIL

Sampling Point: TP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/1	80%	10YR 3/6	20%	C	M	Clay silt loam	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☒ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: ____

Depth (inches):

Hydric Soil Present? Yes☒ No☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (Inches):
Water Table Present?	Yes ☒	No ☐	Depth (Inches): 0
Saturation Present? (Includes Capillary fringe)	Yes ☒	No ☐	Depth (Inches): 0

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/2015
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-5
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: Convex Slope (%): 0-3%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: CvA NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☒ No☐
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes☐ No☒ Hydric Soils Present? Yes☐ No☒ Wetland Hydrology Present? Yes☐ No☒	**Is the Sampled Area within a Wetland?**	**Yes☐ No☒**

Remarks:

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Corylus cornuta*	20%	yes	FACU
2.	%		
3.	%		
4.	%		
Total Cover:	20%		
Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1. *Holodiscus discolor*	10%	yes	FACU
2. *Oemleria cerasiformis*	5%	yes	FACU
3.	%		
4.	%		
5.	%		
Total Cover:	15%		
Herb Stratum (Plot size: 5 ft radius)			
1. *Galium trifidum*	40%	yes	FACW
2. *Polystichum munitum*	30%	yes	FACU
3. *Claytonia perfoliata*	10%	no	FAC
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	80%		
Woody Vine Stratum (Plot size: 30 ft radius)			
1. *Rubus ursinus*	5%	yes	FACU
2.	%		
Total Cover:	5%		

% Bare Ground in Herb Stratum 20%

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 17 (A/B)

Prevalence Index worksheet

Total % Cover of:	Multiply by:
OBL species	x 1=
FACW species	x 2=
FAC species	x 3=
FACU species	x 4=
UPL species	x 5=
Column Totals: (A)	(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☐ No☒

Remarks:

SOIL

Sampling Point: TP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/3	100%		%			Silt loam	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: ____

Depth (inches):

Hydric Soil Present? Yes☐ No☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (Inches):
Water Table Present?	Yes ☐	No ☒	Depth (Inches):
Saturation Present? (Includes Capillary fringe)	Yes ☐	No ☒	Depth (Inches):

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/2015
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-6
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: Concave Slope (%): 8-20%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: HcD NWI classification: PFOA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☒ No☐
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** Yes☒ No☐
Hydric Soils Present?	Yes ☒ No ☐	
Wetland Hydrology Present?	Yes ☒ No ☐	

Remarks:

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus latifolia*	20%	yes	FACW
2. *Acer macrophyllum*	10%	yes	FACU
3.	%		
4.	%		
Total Cover:	30%		

Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1. *Cornus sericea*	30%	yes	FACW
2.	%		
3.	%		
4.	%		
5.	%		
Total Cover:	30%		

Herb Stratum (Plot size: 5 ft radius)			
1. *Veratrum californicum*	40%	yes	FAC
2. *Oenanthe sarmentosa*	20%	yes	OBL
3. *Mentha arvensis*	10%	no	FACW
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	70%		

Woody Vine Stratum (Plot size: 30 ft radius)			
1.	%		
2.	%		
Total Cover:	%		

% Bare Ground in Herb Stratum 30%

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC 80 (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1=	
FACW species		x 2=	
FAC species		x 3=	
FACU species		x 4=	
UPL species		x 5=	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ **Wetland Non-Vascular Plants[1]**
- ☐ **Problematic Hydrophytic Vegetation[1] (Explain)**

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☒ No☐

Remarks:

SOIL

Sampling Point: TP-6

Profile Description: (Describe to the depth needed to document the Indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/1	80%	2.5 YR 3/6	20%	C		Silt clay loam	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: ____

Depth (inches):

Hydric Soil Present? **Yes☒ No☐**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ **Surface Soil Cracks (B6)**
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ **Other (Explain in Remarks)**
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (Inches):
Water Table Present?	Yes ☒	No ☐	Depth (Inches): 4
Saturation Present? (Includes Capillary fringe)	Yes ☒	No ☐	Depth (Inches): 0

Wetland Hydrology Present? **Yes ☒ No ☐**

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys and Coast Region

Project/Site: Parklands at Camas Meadows City/County: Camas/Clark Sampling Date: 4/28/2015
Applicant/Owner: Parklands at Camas, LLC/Chinook Land Owners Group, LLC State: WA Sampling Point: TP-7
Investigator(s): T. Haderly & R.Allison Section, Township, Range: S28,T2N,R3E
Landform (hillslope, terrace, etc.): Terrace Local relief: Convex Slope (%): 8-20%
Subregion (LRR): A Lat: 45.3736 Long: -122.2654 Datum: NAD83
Soil Map Unit Name: HcD NWI classification: PFOA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes☒ No☐ (If no, explain Remarks.)
Are Vegetation☐, Soil☐, or Hydrology☐ significantly disturbed? Area "Normal Circumstances" present? Yes☒ No☐
Are Vegetation☐, Soil☐, or Hydrology☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes☐ No☒
Hydric Soils Present?	Yes ☐ No ☒	
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks:

VEGETATION (*Use scientific names*)

Tree Stratum (Plot size:30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Thuja plicata*	20%	yes	FAC
2. *Pseudotsuga menziesii*	20%	yes	FACU
3. *(non- native) Cedar sp.*	20%	yes	
4. *Acer macrophyllum*	10%	no	FAC
Total Cover:	70%		
Sapling/Shrub Stratum (Plot size: 5 ft. radius)			
1.	%		
2.	%		
3.	%		
4.	%		
5.	%		
Total Cover:	%		
Herb Stratum (Plot size: 5 ft radius)			
1. *Saxifrage sp*	20%	yes	
2.	%		
3.	%		
4.	%		
5.	%		
6.	%		
7.	%		
8.	%		
Total Cover:	20%		
Woody Vine Stratum (Plot size: 30 ft radius)			
1. *Rubus armeniacus*	40%	yes	FACU
2.	%		
Total Cover:	40%		

% Bare Ground in Herb Stratum 40%

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20 (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1=	
FACW species		x 2=	
FAC species		x 3=	
FACU species		x 4=	
UPL species		x 5=	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data In Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology Must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes☐ No☒

Remarks:

SOIL

Sampling Point: TP-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/3	100%		%			Silt loam	
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				
		%		%				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosal (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Minerals (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and Wetland hydrology must be present

Restrictive Layer (if present):

Type: _____

Depth (inches):

Hydric Soil Present? Yes☐ No☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (min. of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or crust (B4)
- ☐ Iron Deposits (B5)
- ☐ **Surface Soil Cracks (B6)**
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, & 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) **(LRR A)**
- ☐ **Other (Explain in Remarks)**
- ☐

Secondary Indicators (2 or more required)

- ☐ Water Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D4

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (Inches):
Water Table Present? Yes ☐ No ☒ Depth (Inches):
Saturation Present? Yes ☐ No ☒ Depth (Inches):
(Includes Capillary fringe)

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX B- WETLAND RATING FORM AND FIGURES

Wetland name or number A,B & C

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetlands A,B & C Date of site visit: 4/28/2015

Rated by Rachel Allison Trained by Ecology? Yes No Date of training March 2015

HGM Class used for rating Depressional Wetland has multiple HGM classes? ___Y __X__N

NOTE: Form is not complete without the figures requested *(figures can be combined).*

Source of base aerial photo/map Google Earth (2014)

OVERALL WETLAND CATEGORY III (based on functions X or special characteristics__)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 – 27

_____**Category II** – Total score = 20 – 22

__X__**Category III** – Total score = 16 – 19

_____**Category IV** – Total score = 9 – 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	H (M) L	H (M) L	H (M) L	
Landscape Potential	H (M) L	H (M) L	H M (L)	
Value	H (M) L	H M (L)	H (M) L	TOTAL
Score Based on Ratings	6	5	5	16

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	Not Applicable

Wetland name or number A,B & C

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet *(can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants *(can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number A,B &C

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

   (NO) – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

   1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   (NO) – go to 3 **YES** – The wetland class is **Flats**
   *If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   ___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ___At least 30% of the open water area is deeper than 6.6 ft (2 m).

   (NO) – go to 4 **YES** – The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
   ___The wetland is on a slope (*slope can be very gradual*),
   ___The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   ___The water leaves the wetland **without being impounded.**

   (NO) – go to 5 **YES** – The wetland class is **Slope**

   NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
   ___The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ___The overbank flooding occurs at least once every 2 years.

Wetland name or number A,B &C

(NO) – go to 6 **YES** – The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 (YES) – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

*If you are still unable to determine which of the above criteria apply to your wetland, or if you have **more than 2 HGM classes** within a wetland boundary, classify the wetland as Depressional for the rating.*

Wetland name or number A,B &C

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	1
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*. Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^1/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^1/_{10}$ of area points = 0	5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	4
Total for D 1 Add the points in the boxes above	10

Rating of Site Potential If score is: ___ 12-16 = H __X__ 6-11 = M ___ 0-5 = L *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source: Nearby subdivision Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	1

Rating of Landscape Potential If score is: ___ 3 or 4 = H __X__ 1 or 2 = M ___ 0 = L *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	0
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	1

Rating of Value If score is: ___ 2-4 = H __X__ 1 = M ___ 0 = L *Record the rating on the first page*

Wetland name or number A,B &C

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?

D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	0
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	3
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire wetland is in the Flats class points = 5	3
Total for D 4 Add the points in the boxes above	6

Rating of Site Potential If score is: ___ **12-16 = H** __X__ **6-11 = M** ___ **0-5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic functions of the site?

D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	2

Rating of Landscape Potential If score is: ___ **3 = H** __X__ **1 or 2 = M** ___ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?

D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	0
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	0

Rating of Value If score is: ___ **2-4 = H** ___ **1 = M** __X__ **0 = L** *Record the rating on the first page*

Wetland name or number A,B &C

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed	4 structures or more: points = 4
__X__Emergent	3 structures: points = 2
__X__Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
__X__Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

__X__The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

4

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated	4 or more types present: points = 3
__X__Seasonally flooded or inundated	3 types present: points = 2
__X__Occasionally flooded or inundated	2 types present: points = 1
__X__Saturated only	1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland	
____Seasonally flowing stream in, or adjacent to, the wetland	
____**Lake Fringe wetland**	**2 points**
____**Freshwater tidal wetland**	**2 points**

2

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

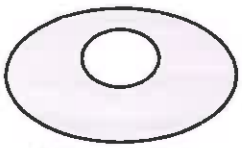
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H 1.4. Interspersion of habitats

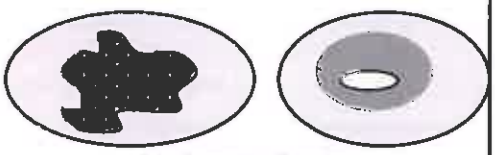
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points



Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3points



3

Wetland name or number A,B &C

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* __X__Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). __X__Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* __X__At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	**3**
Total for H 1 Add the points in the boxes above	**13**

Rating of Site Potential If score is:___**15-18 = H** __**X**__**7-14 = M** ___**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 7 + [(% moderate and low intensity land uses)/2] 7.5 = **14.5** % If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	1
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 28 + [(% moderate and low intensity land uses)/2] 7.5 = **35.5** % Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	-2
Total for H 2 Add the points in the boxes above	0

Rating of Landscape Potential If score is:___**4-6 = H** ___**1-3 = M** __**X**__**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?

H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.*

Site meets ANY of the following criteria: points = 2

- It has 3 or more priority habitats within 100 m (see next page)
- It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)
- It is mapped as a location for an individual WDFW priority species
- It is a Wetland of High Conservation Value as determined by the Department of Natural Resources
- It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan

Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1

Site does not meet any of the criteria above points = 0

Rating of Value If score is:___**2 = H** __**X**__**1 = M** ___**0 = L** *Record the rating on the first page*

Wetland name or number A,B &C

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors:** Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

X **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian:** The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore:** Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number A,B &C

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** (No) **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes – Go to **SC 2.2** (No) – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes = **Category I** No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf (Yes) – **Contact WNHP/WDNR and go to SC 2.4** No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes = **Category I** (No) = **Not a WHCV**	**Cat. I** **Note***
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** (No) – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** (No) = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No = **Is not a bog**	**Cat. I**

Note: Contact was made with Joe Rocchio, Vegetation Ecologist, Washington Dept. of Natural Resources, Natural Heritage Program, on 6/15/2015. Mr. Rocchio confirmed the wetlands were not included in the list of Wetlands of High Conservation Value.

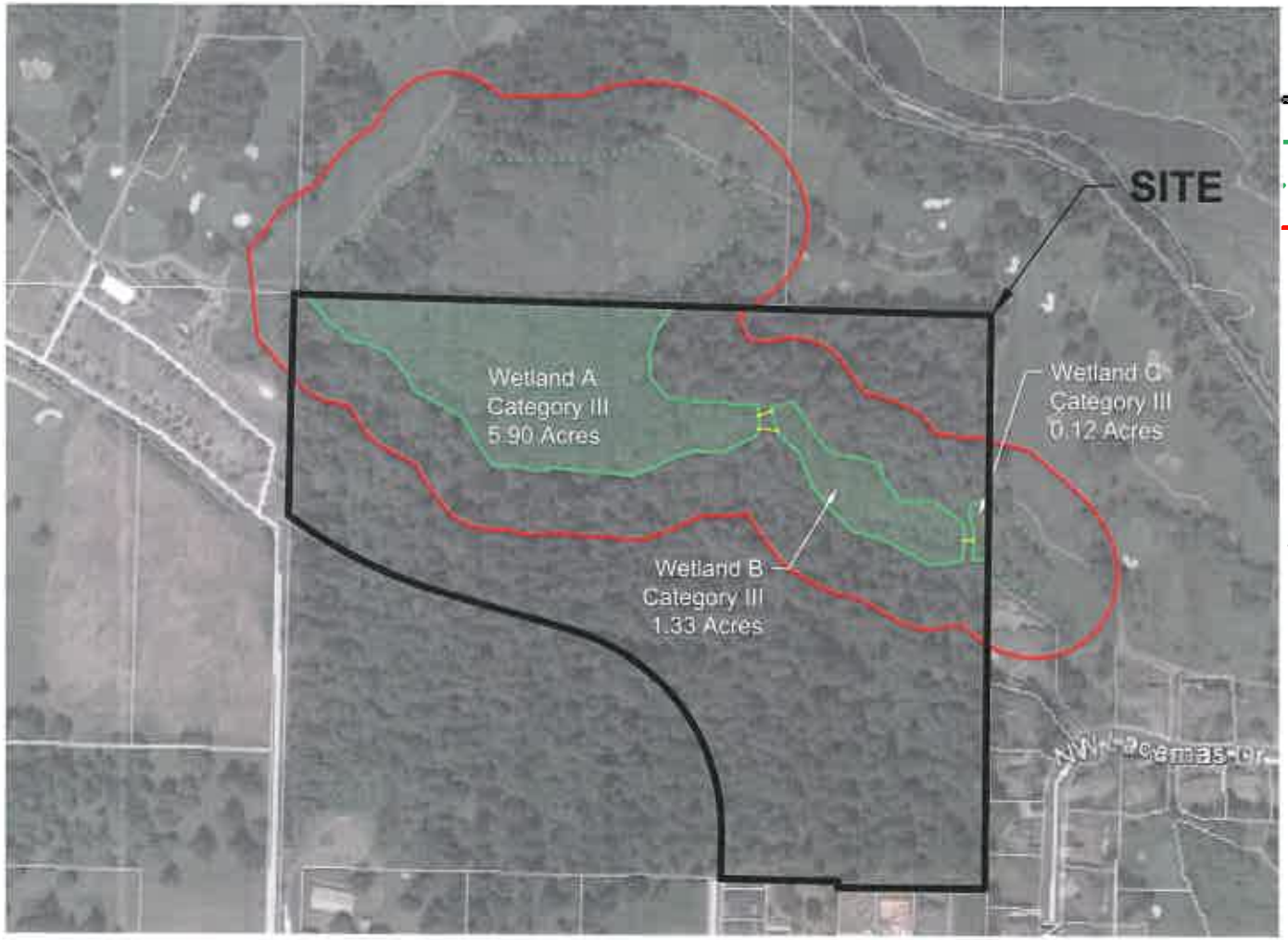
Wetland name or number A, B&C

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** (No) = **Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* Yes – Go to **SC 5.1** (No) = **Not a wetland in a coastal lagoon**	**Cat. I**
SC 5.1. Does the wetland meet all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2) Yes = **Category I** No = **Category II**	**Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: — Long Beach Peninsula: Lands west of SR 103 — Grayland-Westport: Lands west of SR 105 — Ocean Shores-Copalis: Lands west of SR 115 and SR 109 Yes – Go to **SC 6.1** (No) = **not an interdunal wetland for rating**	**Cat I**
SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2**	**Cat. II**
SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? **Yes = Category II** No – Go to **SC 6.3**	**Cat. III**
SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? Yes = **Category III** No = **Category IV**	**Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	**Not Applicable**

Wetland name or number A, B &C

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LEGEND:

- Site Boundary
- Onsite portion of Wetland unit
- Offsite portion of Wetland unit
- Wetland 150' offset

D 2.2->10% of area within 150ft. of wetland in land uses that generate pollutants.

D 5.2- <10% of area within 150ft. of the wetland in land uses that generate excess runoff.

NOTE(S):

1. Base map from ***Google Earth***.™

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Longview, WA 98632
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DATE: 8/12/15
DWN: CDP
REQ. BY: RA
PRJ. MGR: TH
CHK:
PROJECT NO: 2255.01

Figure 6
150' OFFSET RATING FORM
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

Exhibit 16 SP26-1005

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LEGEND:

- Site Boundary
- Onsite portion of Wetland Unit
- Offsite portion of Wetland Unit
- 1 KM Offset

Accessible Land Uses: 7%
Moderate/Low intensity land uses: 13%
Undisturbed Land Uses: 28%
High intensity land uses: 52%

H 2.1- Accessible habitat directly abutting wetland <10% of 1 KM polygon.
H 2.2- Undisturbed habitat within 1KM polygon (10-50% and in 1-3 patches).
H 2.3- >50% of 1KM polygon is high intensity land use.

NOTE(S):

1. Base map from ***Google Earth.***™

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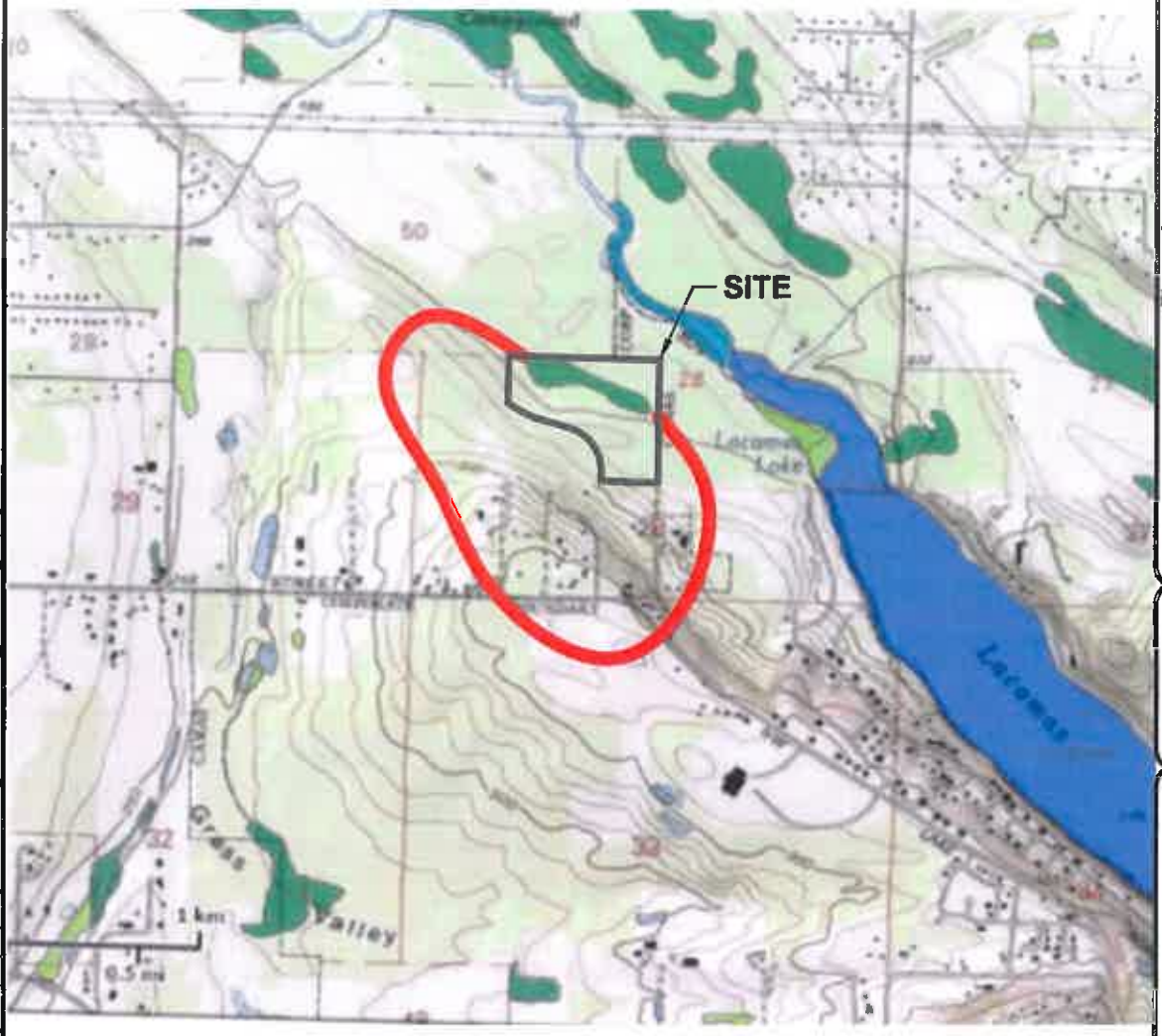
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Figure 7
1 KM OFFSET RATING FORM
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

Exhibit 16 SP26-1005



Wetlands indicated onsite by US Fish & Wildlife Service.

LEGEND:

- Site Boundary
- Contributing Basin
- Freshwater Forested/Shrub Wetland
- Freshwater Emergent Wetland
- Riverine
- Freshwater Pond
- Lake

NOTE(S):

1. Map provided on-line by US Fish & Wildlife Service at web address: *http://www.fws.gov/wetlands/data/index.html*

Figure 8
CONTRIBUTING BASIN MAP
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

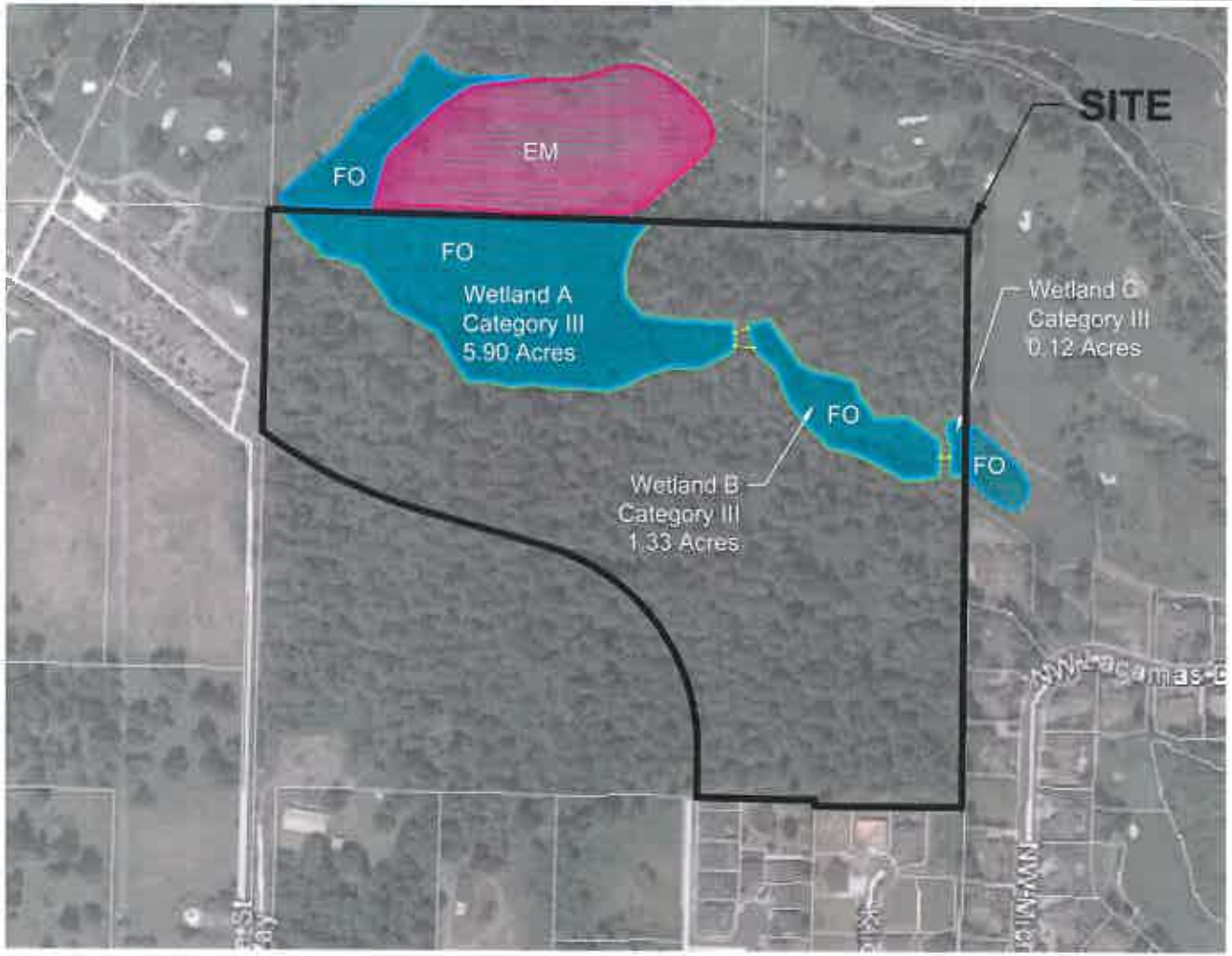
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LEGEND:

- Site Boundary
- Onsite portion of Wetland Unit
- Offsite portion of Wetland Unit
- Cowardin Classes

FO- Forested
EM- Emergent

D 1.3- Wetland has persistent, ungrazed plants >95% of area.
D 4.3- The area of the contributing basin is 10-100 times the area of the unit.
D 5.3- >25% of the contributing basin of the wetland is covered with intensive human land uses.
H 1.1- Emergent, scrub-shrub, forested and forested class has 3 out of 5, strata (moss-ground cover, herbaceous, shrubs, canopy).
H 1.4- Moderately interspersed.

NOTE(S):

1. Base map from ***Google Earth.***™

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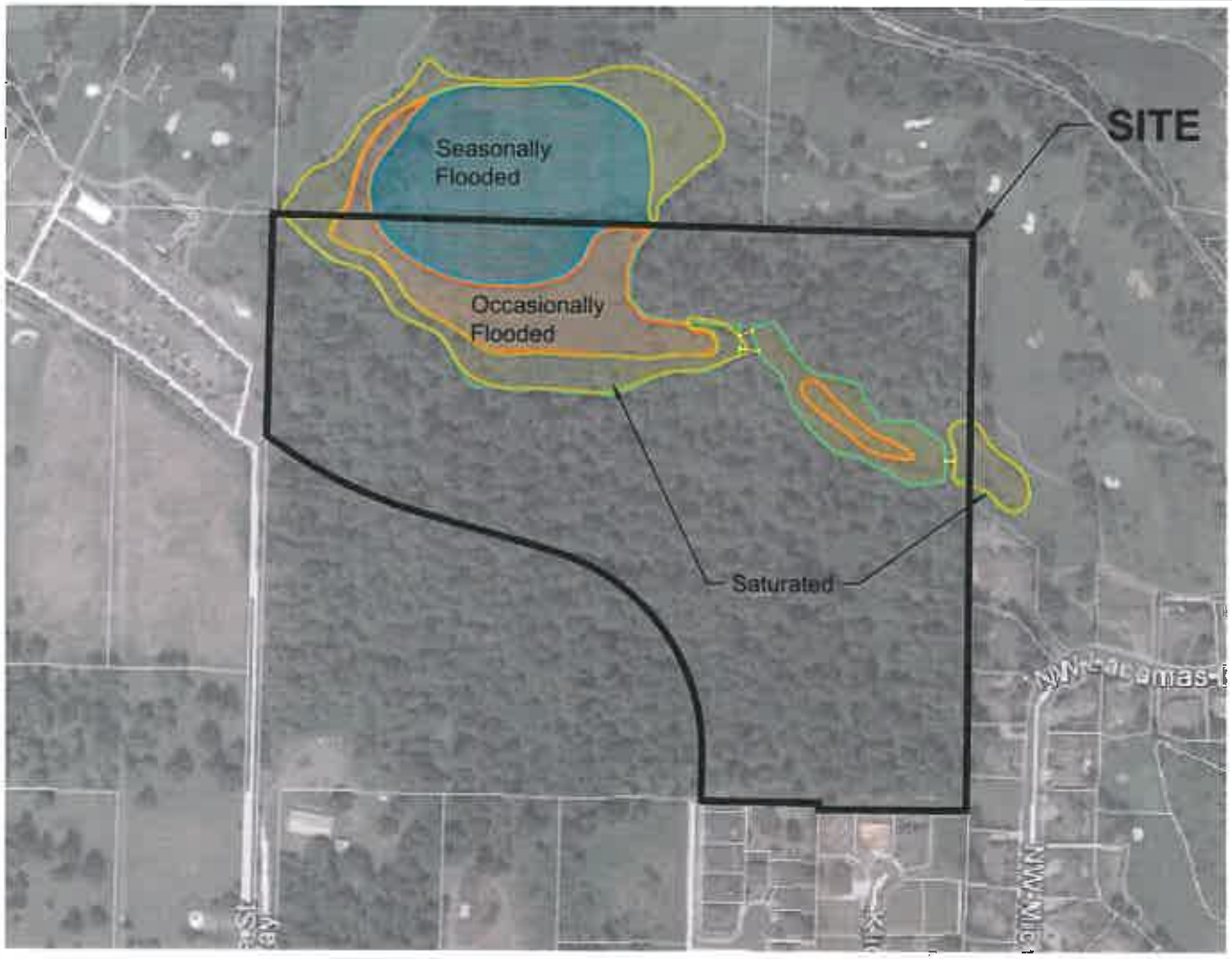
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Figure 9
COWARDIN CLASSES MAP
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

Exhibit 16 SP26-1005



LEGEND:

- Site Boundary
- Wetland
- Saturated
- Occasionally Flooded
- Seasonally

D 1.1 Wetland has an unconstructed outlet.

D 1.4 Area seasonally ponded is >¼ of total wetland area.

H 1.2 Seasonally flooded or inundated occasionally flooded or inundated saturated only.

NOTE(S):

1. Base map from ***Google Earth***.™

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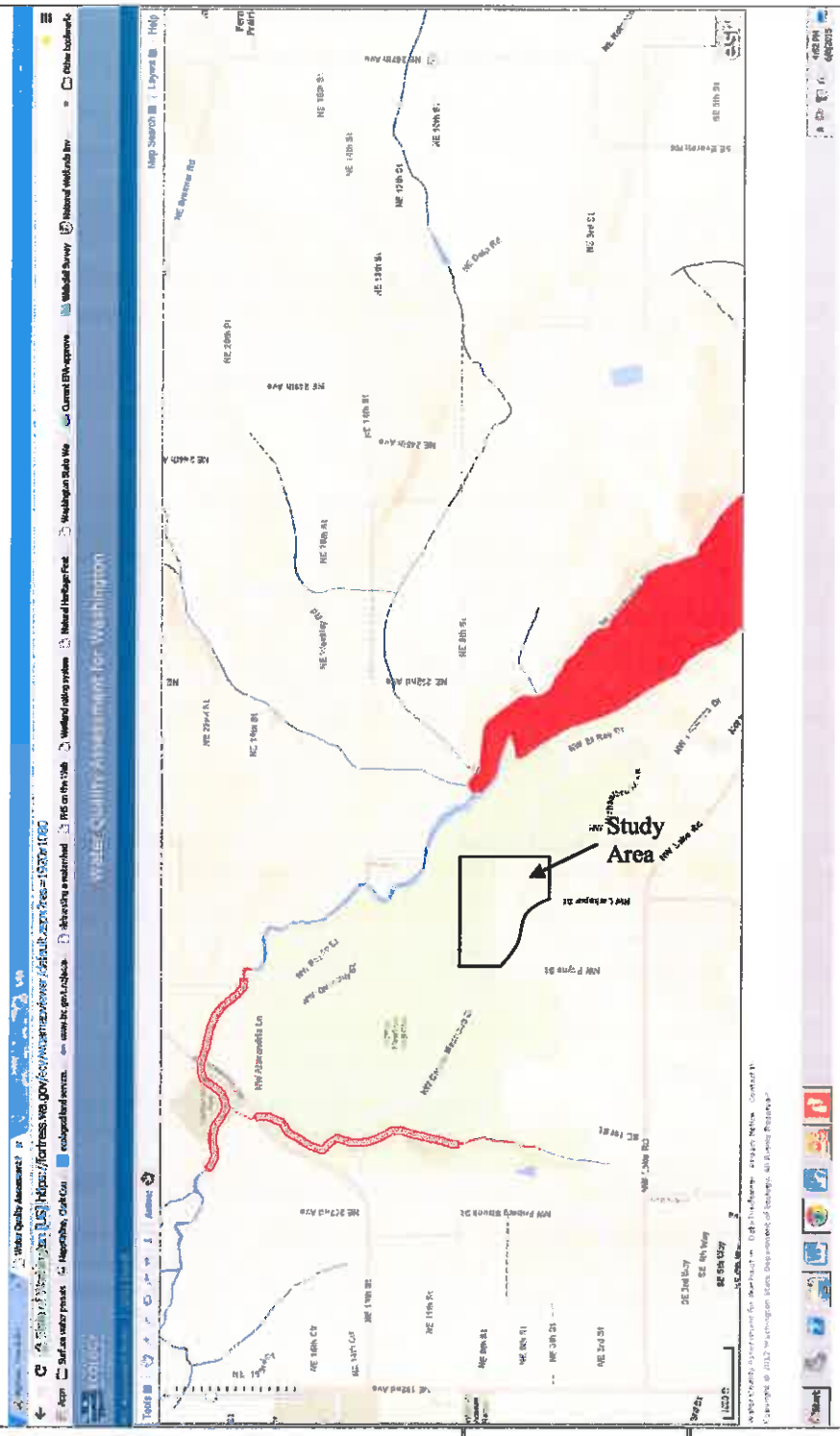
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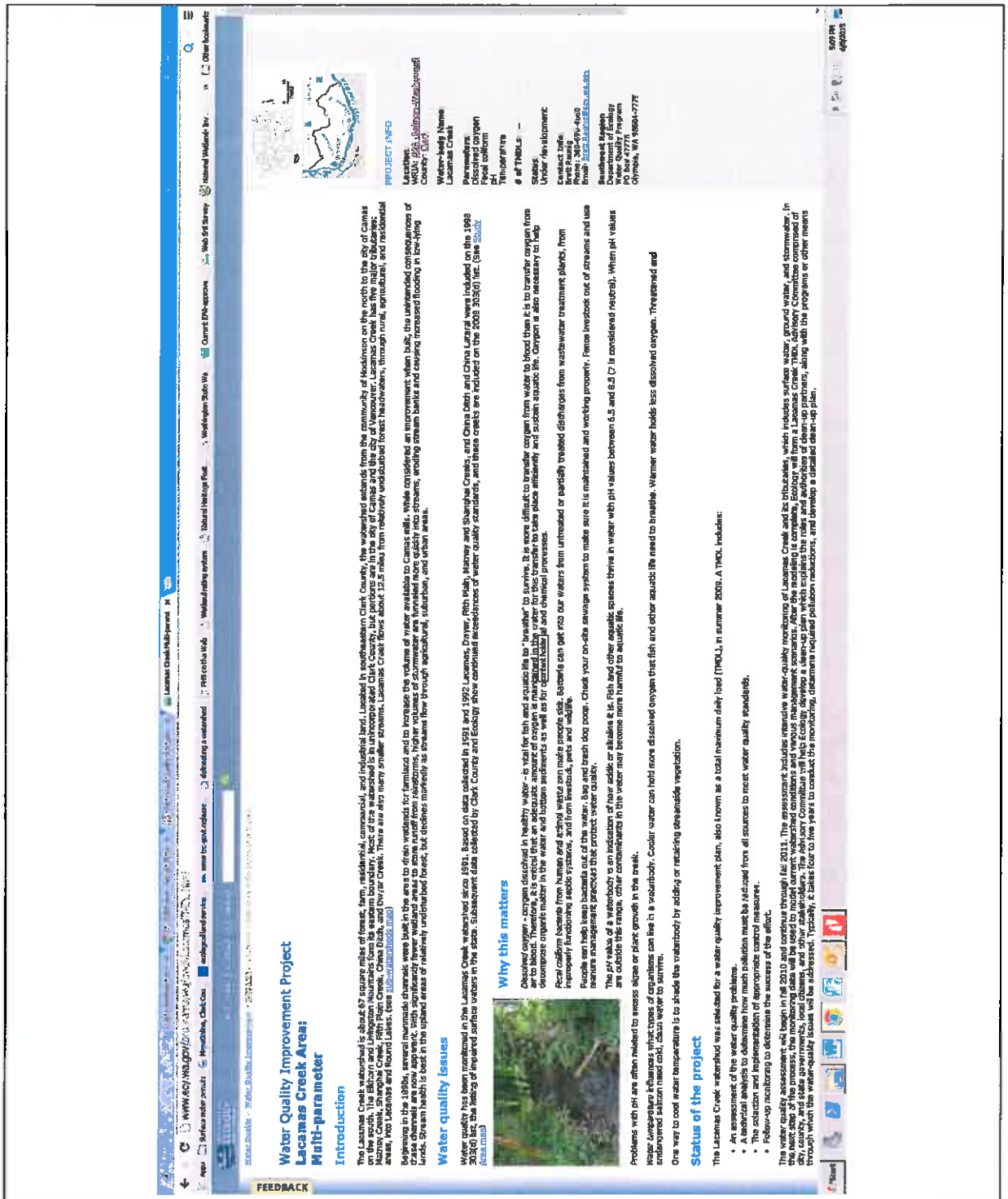
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Figure 10
HYDROPERIODS MAP
Parklands at Camas Meadows
Parklands at Camas LLC.
Camas, Clark County, WA
Section 28, Township 2 N, Range 3 E, W.M.

Exhibit 16 SP26-1005



Ecological Land Services	1157 3rd Ave., Suite 220A Longview, WA 98632 Phone: (360) 578-1371 Fax: (360) 414-9305	DATE: 6/9/15 DWN: LH PRJ. MGR: TH PROJ.#: 2255.01	Figure 11 303(d) Listed Waters in Basin



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Figure 12
TMDLs for WRIA in Unit

PHOTOPLATES 1 & 2



Photo 1: Southern border of Wetland A looking West.



Photo 2: TP6 in Wetland A.



Photo 3: Southern border of Wetland A looking East.

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Photoplate 1



Photo 4: Example of large ash tree in buffer.



Photo 5: Wetland B southern border looking northeast.



Photo 6: Photo of Himalayan blackberry in buffer.

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Photoplate 2

ECOLOGICAL LAND SERVICES, INC.

June 9, 2016

Phil Bourquin
Community Development Director
City of Camas
616 NE 4th Avenue
Camas, WA 98607

Re: Amendment #1 – Final Wetland Delineation Report for Parklands at Camas Meadows – Final Report December 2015.

Dear Mr. Bourquin,

Recent conversations with City staff and engineers working on the proposed Parklands at Camas Meadows project resulted in some concern about statements made in the final wetland delineation report for the project. After reviewing the wetland delineation report and taking comments from City staff and the project engineer into account, I believe the following amendments to the wetland delineation report are justified.

Storm Water Facilities in Wetland buffers

On page 6 of the wetland delineation report, the following bullet was listed:

> 2. Storm water from streets and traffic bearing surfaces will be collected, treated, and conveyed in facilities outside of the wetlands and the associated buffers. The wetlands and buffers will **NOT be used for storm water treatment or detention/retention facilities.**

The intent of this measure was to prohibit the construction of ponds, berms, or structures in the wetland buffer which result in land clearing, tree removal, and extensive grading. Using the wetland buffer to passively dispersive treated storm water should be allowed and will actually be beneficial to the wetland system. I recommend replacing the above bullet with the following:

> 2. ***Storm water from streets and traffic bearing surfaces will be collected and treated, - in facilities outside of the wetlands and the associated buffers. The current storm water design does not propose storm water treatment or detention in the wetlands or associated buffers. Site storm water may be conveyed across buffers via sheet flow or through existing conveyances to the wetlands as necessary.***

Trail in Wetland Buffer

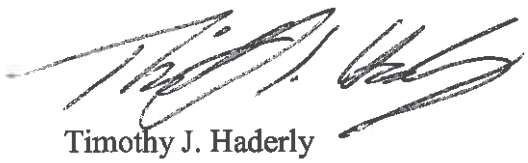
Proposed site developments include the construction of a pedestrian trail through the wetland buffer areas. This trail is designed to provide passive recreational use of the area without having significant impacts to the functions and values of the wetland and associated buffer. That said, the

1157 - 3rd Avenue, Suite 220 • Longview, Washington 98632 •. (360) 578-1371 • Fax (360) 414-9305

trail will be located within a sinuous corridor avoiding mature trees and other sensitive habitat features including snags, large stumps, nests, etc. The trail bed will be constructed using porous material including, but not limited to, wood chips, bark chips, porous gravel, porous pavers, and other materials that allow water to infiltrate while providing stable footing.

If you have any questions I can be contacted at (360) 578-1371 or timh@eco-land.com.

Sincerely,



Timothy J. Haderly
Senior Ecologist/Principal

APPENDIX H

H-1 Maintenance and Operations Manual

MAINTENANCE AND OPERATIONS MANUAL

PARKLANDS SUBDIVISION AND ARCHERY BUSINESS PARK

AUGUST 19, 2016

KESSI ENGINEERING
6400 NE Hwy 99 #G-169
Vancouver, WA 98665

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Only site specific elements have been selected
– the page references blow relate to the City of Camas Manual

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Manual Layout
The manual breaks out the various storm sewer system components and the general maintenance activities required for said component. For each component or activity this manual will:

- Briefly describe the component type, e.g. facility or activity.
- List the water quality and non-water quality result of each facility or activity.
- List the *Best Management Practices (BMP's)* needed to meet the water quality and general maintenance requirements.

Additional information may be found in other manuals, such as the Washington Department of Ecology's *2005 Stormwater Management Manual for Western Washington, Vols. IV and V*, or site specific Operation and Maintenance (O&M) Manuals.

Maintenance is performed as a means to obtain specific results. The maintenance results, as listed below, are specified for each drainage feature or activity. They include maintaining performance and appearance of the facility, and the need to prevent maintenance work itself from becoming a pollutant source or damaging habitat.

Maintenance Results (R1-R10)
Water Quality Results:
R1 Avoid or minimize sediment and pollutant discharges from the work area.
R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
R3 Avoid or minimize vegetation removal.
R4 Preserve native vegetation.

Infrastructure Maintenance Results:
R5 Protect public safety and health.
R6 Prevent catastrophique infrastructure failures.
R7 Maintain and/or restore the intended infrastructure function.
R8 Prevent and/or reduce flooding.
R9 Protect infrastructure.
R10 Meet public expectations for aesthetics.

Storm sewer facility refers to specific drainage features, such as catch basins, pipes, ditches, ponds, biofiltration swales, and infiltration systems. Activities refer to maintenance tasks associated with operating and maintaining stormwater facilities such as vegetation management

and small repair projects. Depending on the extent of the maintenance, some property owners may be able to handle storm sewer maintenance themselves. Often, however, depending on the type of maintenance, the property owners will contract out the work. Landscapers are often employed to maintain vegetated facilities, such as swales and pond areas.

Heavier work, like cleaning catch basins, ditch inlets, outlet structures, or drywells often requires special equipment, such as trucks that can vacuum out sediment. When located within the city right-of-way, maintenance is typically the responsibility of the City. For those located on private property, a contractor would need to be contacted to perform this work. Check phone book listings, such as sewer and cleaning contractors, tank cleaning, and environmental and ecological services. Check with the contractor to ensure that all materials are disposed of according to solid waste and hazardous materials regulations. *Ultimately, the generator of the waste or hazardous material is responsible for proper disposal.*

Special Facilities:
Manufactured storm sewer facilities, such as leaf compost filters and oil/water separators often have maintenance requirements and manuals specified or written by the manufacturer. Also, larger or more complex storm sewer facilities may include specifications for maintenance and vegetation management that provide specific detail above and beyond this manual. Where the *Public Works Director* determines that these manuals or plans provide an equal or greater level of maintenance and water quality protection, then these procedures shall be followed by the owner. The Public Works Director must approve these individual maintenance plans, specifications, or manuals.

Catch Basins and Curb Inlets

Catch basins and curb inlets trap sediment and some oils that are washed off the road surface during a storm event. This sediment and the oils if not removed from the basins and inlets have the potential to pollute water bodies. They need to be inspected and cleaned at a minimum annually, more often if necessary; to remove accumulated sediment, fluids, and trash.

Maintenance Results

- R1 Avoid or minimize sediment and pollutant discharges from the work area.
- R2 Prevent parking areas, roads, drainage systems, facilities, and property from becoming pollutant sources.
- R7 Maintain or restore the intended infrastructure function
- R8 Prevent or reduce flooding.
- R9 Protect infrastructure.

Procedures

Inspection

Inspect catch basins and curb inlets at least once per year, more often if necessary.

Periodically inspect the catch basin or curb inlets and surrounding areas for pollutants, such as leaks from dumpsters, minor spills, and oil dumping. Act to have the pollutant source removed. Ensure that grass clippings and leave debris is not being blown into the streets.

Cleaning

Clean catch basins and curb inlets when they become one third full in order to maintain sediment-trapping capacity. Catch basin, curb inlet, and manhole cleaning should be performed in a manner that keeps removed sediment and contaminated water from being discharged back into the storm sewer.

Clean putrid materials from the catch basins and curb inlets when discovered or reported.

Keep the inlet grates cleared of debris and litter.

Safety

Work inside underground structures (e.g. manholes) requires special OSHA-required confined space equipment and procedures. The most practical option may be to contract with a sewer-cleaning contractor for this work.

Materials Handling

Disposal of waste from maintenance of drainage facilities shall be conducted in accordance with federal, state, and local regulations, including the Minimum Functional Standards for Solid Waste handling Chapter 173-304 WAC; guidelines for disposal of waste materials; and where appropriate, Dangerous Waste Regulations, Chapter 173-303 WAC.

Removed sediment must be disposed of in the garbage as solid waste. Contaminated water should be disposed of in a sanitary sewer after oils are removed using oil absorbent materials or other mechanical means. Used oil absorbents should be recycled or disposed according to the manufacture's instructions.

Repairs

Repair any damages that prevent the catch basin or curb inlet from functioning as designed. An example is a broken or missing outlet elbow.

Follow the Procedures described under the Activity: Installation, Repair and Replacement of Enclosed Drainage Systems.

Energy Dissipaters

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.

Maintenance Results

R1 Avoid or minimize sediment and pollutant discharges from the work area.
R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
R7 Maintain or restore the intended infrastructure function.
R8 Prevent or reduce flooding.
R9 Protect infrastructure.

Procedures

Inspection

Inspect at least once per year.

Cleaning

Remove any accumulated litter.
Dispersion trenches: remove sediment from pipe when it reaches 20 percent of the pipe diameter.

Repairs

Rock splash pads: replace missing or moved rocks to cover exposed soil and meet design standards.

Dispersion trenches: repair conditions that cause concentrated flow along the trench. Clean pipe perforations when one-half of them are plugged or if flows bypass or overflow the trench.

Manhole/Chamber: when the structure deteriorates to one-half its original size or it becomes structurally unsound, replace it to the design standards.

Follow the practice described under the Activity: Installation, Repair and Replacement of Enclosed Drainage Systems.

Manholes

Manholes are large cylindrical vaults usually set at storm sewer pipe connections. Unless you have OSHA approved training and equipment, never enter a manhole. There is a considerable risk of poisonous gas and injury.

Maintenance Results

- R1 Avoid or minimize sediment and pollutant discharges from the work area.
- R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
- R7 Maintain or restore the intended infrastructure function.
- R8 Prevent or reduce flooding.
- R9 Protect infrastructure.

Procedures

Inspection

Inspect the manhole once per year. Check frame and lid for cracks and wear, such as rocking lids or lids move by traffic.

Periodically inspect the manhole and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

Cleaning

Clean manholes when there is a blockage of the stormwater channel. Cleaning should be performed in a way that ensures removed sediment and water is not discharged back into the storm sewer.

Safety

Never enter a confined space without proper training and safety gear. Work inside underground structures requires special OSHA-required confined space equipment and procedures. The most practical option may be to contract with a sewer-cleaning contractor.

Materials Handling

Disposal of waste from maintenance of drainage facilities shall be conducted in accordance with federal, state, and local regulations, including the Minimum Functional Standards for Solid Waste handling Chapter 173-304 WAC; guidelines for disposal of waste materials; and where appropriate, Dangerous Waste Regulations, Chapter 173-303 WAC.

Removed sediment must be disposed of in the garbage as solid waste. Contaminated water should be disposed of in a sanitary sewer after oils are removed using oil absorbent materials or other mechanical means. Used oil absorbents should be recycled or disposed according to the manufacture's instructions.

Repairs
Repair all security and access features so they are fully functional. This includes locking lids, cover, and ladder rungs.

Replace broken parts or lids that rock or are moved by traffic.

Follow the practice described under the Activity: Installation, Repair and Replacement of Enclosed Drainage Systems.

Storm Sewer/Drain 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.

Maintenance Results

- O1 Avoid or minimize sediment and pollutant discharges from the work area.
- O2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
- O7 Maintain or restore the intended infrastructure function.
- O8 Prevent or reduce flooding.
- O9 Protect infrastructure.

Procedures

Inspection

Pipes are difficult to inspect requiring special equipment and training. Usually, if a problem occurs the owner needs to call a sewer of plumbing contractor to inspect, repair, or clean pipelines.

Cleaning

Clean pipes when sediment depth is greater than 20 percent of pipe diameter. When cleaning a pipe, minimize sediment and debris discharges from pipes to the storm sewer. Install downstream debris traps (where applicable) before cleaning and then remove material.

Generally, use mechanical methods to remove root obstructions from inside storm sewer pipes. Do not put root-dissolving chemicals in storm sewer pipes. If there is a problem, remove the vegetation over the line.

Safety

Work inside underground structures requires special OSHA-required confined space equipment and procedures. The most practical option may be to contract with a sewer-cleaning contractor.

Materials Handling

Sediment and debris from pipes should be disposed in the garbage as solid waste. Pick out any rocks first.

Repairs

Repair or replace pipes when a dent or break closes more than 20 percent of the pipe diameter.

Repair or replace pipes damaged by rust or deterioration.

Follow the practice described under the Activity: Installation, Repair, and Replacement of Enclosed Drainage Systems.

FloGard Perk Filter™ (using ZPC Filter Media)

Reference: June 2016 - GENERAL USE LEVEL DESIGNATION FOR BASIC AND PHOSPHORUS TREATMENT
For Kristar/Oldcastle Precast, Inc. FloGard Perk Filter™ (using ZPC Filter Media)

Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

- Typically, Kristar/Oldcastle designs PerkFilter systems for a target filter media replacement interval of 12 months. Maintenance includes removing accumulated sediment from the vault, and replacing spent cartridges with recharged cartridges.

- Indications of the need for maintenance include effluent flow decreasing to below the design flow rate, as indicated by the scumline above the shoulder of the cartridge.

- Owners/operators must inspect PerkFilter for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability. When inspections are performed, the following findings typically serve as maintenance triggers:
  - Accumulated vault sediment depths exceed an average of 2 inches, or
  - Accumulated sediment depths on the tops of the cartridges exceed an average of 0.5 inches, or
  - Standing water remains in the vault between rain events, or
  - Bypass occurs during storms smaller than the design storm.

- Note: If excessive floatables (trash and debris) are present, perform a minor maintenance consisting of gross solids removal, not cartridge replacement.

Maintenance Results

R1 Avoid or minimize sediment and pollutant discharges from the work area.
R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
R7 Maintain or restore the intended infrastructure function.
R9 Protect infrastructure.

Procedures

Inspection
Inspect the structure (see third bullet in above list). The inspection should determine sediment depth and the specific maintenance and repairs needed.

Inspect annually for cracks large enough to let soil enter the vault, broken or defective plates and baffles, and crushed or damaged pipes.

Periodically inspect the structure and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

Cleaning
Remove trash and litter from the vault, inlet, and piping.

Remove sediment when it accumulates to 2-inches in depth in the vault

Remove sediment when it accumulates on filter media.

Replace media cartridges per manufacture's recommendation.

Safety
Work inside underground structures requires special OSHA-required confined space equipment and procedures. The most practical option may be to contract with a sewer-cleaning contractor.
Materials Handling

Disposal of waste from maintenance of drainage facilities shall be conducted in accordance with federal, state, and local regulations, including the Minimum Functional Standards for Solid Waste handling Chapter 173-304 WAC; guidelines for disposal of waste materials; and where appropriate, Dangerous Waste Regulations, Chapter 173-303 WAC.

Removed sediment must be disposed of in the garbage as solid waste. Contaminated water should be disposed of in a sanitary sewer after oils are removed using oil absorbent materials or other mechanical means. Used oil absorbents should be recycled or disposed according to the manufacture's instructions.

Repairs
Repair any cracked or defective plates or baffles. Cracks are repaired so that no cracks greater than ¼-inch are found.

Replace media cartridges if it takes longer than an hour for water to empty through media or if water frequently overflows the treatment chamber. Replace defective cartridges.

Repair all security and access features so they are fully functional. This includes locking lids, covers, and ladder rungs.

Follow the practice described under the Activity: Installation, Repair, and Replacement of Enclosed Drainage Systems.

Access Roads and Easements

Most stormwater facilities have access roads to bring in heavy equipment for facility maintenance. These roads should be maintained for inspection access and ease of equipment access.

Maintenance Results

- R1 Avoid or minimize sediment and pollutant discharges from the work area.
- R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
- R7 Maintain or restore the intended infrastructure function.
- R10 Meet public expectations for aesthetics.

Procedures

Inspection

Inspect once a year or when facilities are maintained.

Cleaning

Remove litter when mowing or when there is any accumulation.

Remove any debris that blocks roads or may damage tires.

Vegetation Management

Manage vegetation as for the rest of the facility. Trees and shrubs may be removed from access roads and easements if they block access for necessary maintenance or will prevent or harm intended stormwater facility function. Use of pesticides is prohibited unless prior approval is received from the City.

Repairs

Correct any bare or eroded soils by seeding or a cover BMP.

Repair road surfaces when they may lead to erosion or limit equipment access.

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 is also part of storm sewer maintenance procedure because it limits the amount of sediment washed into the storm sewer facilities. 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.

Maintenance Results

- R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
- R5 Protect public safety and health.
- R10 Meet public expectations for aesthetics.

Procedures

Inspection

Inspect on a weekly basis, depending on traffic volumes.

Cleaning

Sweep the site to help keep sediment from entering storm sewer systems and water bodies.

Sweeping is especially useful for cleaning up work areas.

Sweeping can be as easy as using a couple of push brooms or as involved as using mechanical methods.

Materials Handling

Disposal of waste from maintenance of drainage facilities shall be conducted in accordance with federal, state, and local regulations, including the Minimum Functional Standards for Solid Waste handling Chapter 173-304 WAC; guidelines for disposal of waste materials; and where appropriate, Dangerous Waste Regulations, Chapter 173-303 WAC.

Sweepings should be disposed of as solid waste or under a program permitted by the Southwest Washington Health District.

Installation, Repair, and Replacement of Enclosed Drainage Systems

This chapter includes tasks such as repair and replacement of pipe, catch basins, drywells, and manholes. It also includes drainage projects that add new pipes, catch basins, or infiltration structures. New drainage projects are subject to regulations under CMC 15.36 Erosion/Sediment Control Plans.

Maintenance Results

R1 Avoid or minimize sediment and pollutant discharges from the work area.
R2 Prevent parking areas, roads, drainage systems, and drainage facilities from becoming pollutant sources.
R7 Maintain or restore the intended infrastructure function. R8 Prevent or reduce flooding.

Procedures

Cleaning

Avoid or minimize vegetation removal. If work is near a stream or wetland, there are regulatory requirements to must be met.

Prevent debris, oils, cleaning agents, and sediment from entering waterways.

Avoid or minimize work in wet weather. This will reduce the problems of containing sediment.

Carry spill control kit on-site to contain and clean up possible small spills in the work area, e.g. oil spills.

Protect our storm systems:

- Install sediment traps around curb inlets and catch basins, e.g. biobags or gravel filled pillows.
- Install catch basin inserts.
- Sweep or vacuum dust and debris from the repair job. Do not wash materials into storm sewers.
- Place stockpiles away from drainage ways, wetlands, and natural wetland and habitat buffers. Cover stockpiles or contain them with berms or other containment devices.
- At stream crossings, trap material using screens or another approved form of containment. Use containment BMP's to protect roadside ditches during wet weather.

Ensure that along with the approved erosion/sediment control measures that are in-place prior to construction, that there is an emergency sediment control kit for unexpected problems; e.g. trench dewatering. This should include:

- Sediment bag,
- Additional biobags and catch basin inserts,
- Push brooms and flat edge shovels.

Minor Culvert Repair (not in a natural 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.

Maintenance Results

R1 Avoid or minimize sediment and pollutant discharges from the work area. R3 Avoid or minimize vegetation removal.
R7 Maintain or restore the intended infrastructure function. R8 Prevent or reduce flooding.
R9 Protect infrastructure.

Procedures

Comply with erosion/sediment control requirements in CMC 15.32.

Avoid or minimize vegetation removal. If work is near a stream or wetland, there are likely to be regulatory requirements.

Other than to address a threat to public safety or property due to flooding, perform work during the dry season.

Minimize soil disturbance.

Use sediment controls to trap any sediment and prevent sediment from entering the storm sewer and water bodies. Sediment trapping BMP's are to be used to the extent practical during emergencies. An emergency sediment control kit is highly recommended.

Use cover BMP's to prevent erosion of bare soil. Vegetate bare soils.

Operation & Maintenance Procedures: Vegetation Management

General Goals and Philosophy

The City of Camas 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 Integrated Pest Management (IPM) principles and decision-making rationale. These are as follows:

- Proper planning and management decisions begin the IPM process.
- Cultural methods of vegetation and pest control are preferred and are first employed.
- Mechanical means of vegetation and pest control are next in line of preference, and are utilized where feasible.
- Biological methods of vegetation and pest control are considered before chemical means, where they are feasible.
- Botanical and synthetic pesticides are used only when no other feasible methods exist.

General Procedures

Use Only Appropriate Plants

The City of Camas 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 List are allowed for use within the City's right-of-way, storm sewer facilities, and wetland buffers.

Mulching

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.

Always consider the possible impacts when using mulches, which may include:

- Inadvertent introduction of non-native plants and diseases to the site.
- Leaching of substances such as tannins from the mulch into nearby waterways.
- Migration of mulch material in waterways.
- Nutrient leaching into waterways.

This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.

BK 311 PG 924

ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 1 OF 6

RESIDENTIAL PLAT NOTES (LOTS 1–42):

1. A HOMEOWNER'S ASSOCIATION (H.O.A.) IS REQUIRED FOR THE PARKLANDS DEVELOPMENT. COPIES OF THE CC&R'S ARE ON FILE WITH THE CITY OF CAMAS.
2. ALL COSTS ASSOCIATED WITH THE INSTALLATION OF THE STEP SYSTEMS FOR INDIVIDUAL LOTS WILL BE THE RESPONSIBILITY OF SAID INDIVIDUAL LOT OWNERS.
3. A RIGHT OF ENTRY IS HEREBY GRANTED TO THE CITY OF CAMAS FOR THE REPAIR AND MAINTENANCE OF THE STEP SEWER SYSTEM.
4. SEE TABLE 1 ON SHEET 6 OF THIS PLAT FOR THE DIMENSIONAL STANDARDS FOR THE LOTS IN THIS DEVELOPMENT PER THE ADOPTED DEVELOPER'S AGREEMENT.
5. NO FURTHER SHORT PLATTING OR SUBDIVIDING OF THE LOTS CONTAINED WITHIN THIS SUBDIVISION WILL BE PERMITTED.
6. THE LOTS IN THIS SUBDIVISION ARE SUBJECT TO TRAFFIC IMPACT FEES, SCHOOL IMPACT FEES, FIRE IMPACT FEES AND PARK/OPEN SPACE IMPACT FEES. EACH NEW DWELLING UNIT WILL BE SUBJECT TO THE PAYMENT OF APPROPRIATE IMPACT FEES AT THE TIME OF BUILDING PERMIT ISSUANCE OR AS OTHERWISE PROVIDED BY THE CITY.
7. A FINAL OCCUPANCY PERMIT WILL NOT BE ISSUED BY THE BUILDING DEPARTMENT UNTIL ALL SUBDIVISION IMPROVEMENTS ARE COMPLETED AND ACCEPTED.
8. PRIOR TO THE BUILDING DEPARTMENT ISSUING A CERTIFICATE OF OCCUPANCY, EACH LOT SHALL INSTALL A MINIMUM OF ONE 2" CALIPER TREE TO BE LOCATED IN THE PLANTER STRIP OR FRONT YARD OF EACH LOT. SPECIFIED TREES SHALL BE MAINTAINED IN GOOD HEALTH, AND DAMAGED OR DYING TREES SHALL BE REPLACED WITHIN SIX MONTHS BY THE HOMEOWNER.
9. AUTOMATIC FIRE SPRINKLER SYSTEMS DESIGNED AND INSTALLED IN ACCORDANCE WITH NFPA 13D ARE REQUIRED IN ALL RESIDENCES.
10. ILLEGALLY PARKED VEHICLES MAY BE SUBJECT TO TOWING OR OTHER PRIVATE PARKING ENFORCEMENT MEASURES IN ACCORDANCE WITH THE PROVISIONS OUTLINED IN THE H.O.A. DOCUMENTS AND C.C.&R'S.
11. SHOULD ARCHAEOLOGICAL MATERIALS (E.G. CONES, SHELL, STONE TOOLS, BEADS, CERAMICS, OLD BOTTLES, HEARTH, ETC.) BE OBSERVED DURING PROJECT ACTIVITIES, ALL WORK IN THE IMMEDIATE VICINITY SHOULD STOP AND THE STATE DEPARTMENT OF ARCHAEOLOGY AND HISTORIC PRESERVATION (360-586-3534), THE CITY PLANNING OFFICE, AND THE AFFECTED TRIBE(S) SHOULD BE CONTACTED IMMEDIATELY. IF ANY HUMAN REMAINS ARE OBSERVED, ALL WORK SHOULD CEASE AND THE IMMEDIATE AREA SECURED. LOCAL LAW ENFORCEMENT, THE COUNTY MEDICAL EXAMINER (360-397-8405), STATE PHYSICAL ANTHROPOLOGIST, DEPARTMENT OF ARCHAEOLOGY, AND AFFECTED TRIBE(S) SHOULD BE CONTACTED IMMEDIATELY. COMPLIANCE WITH ALL APPLICABLE LAWS PERTAINING TO ARCHAEOLOGICAL RESOURCES (RCW 27.53, 27.44 AND WAC 25-48) AND HUMAN REMAINS (RCW 68.50) IS REQUIRED. FAILURE TO COMPLY WITH THIS REQUIREMENT COULD CONSTITUTE A CLASS C FELONY.

BUSINESS PARK PLAT NOTES (LOTS 43–47):

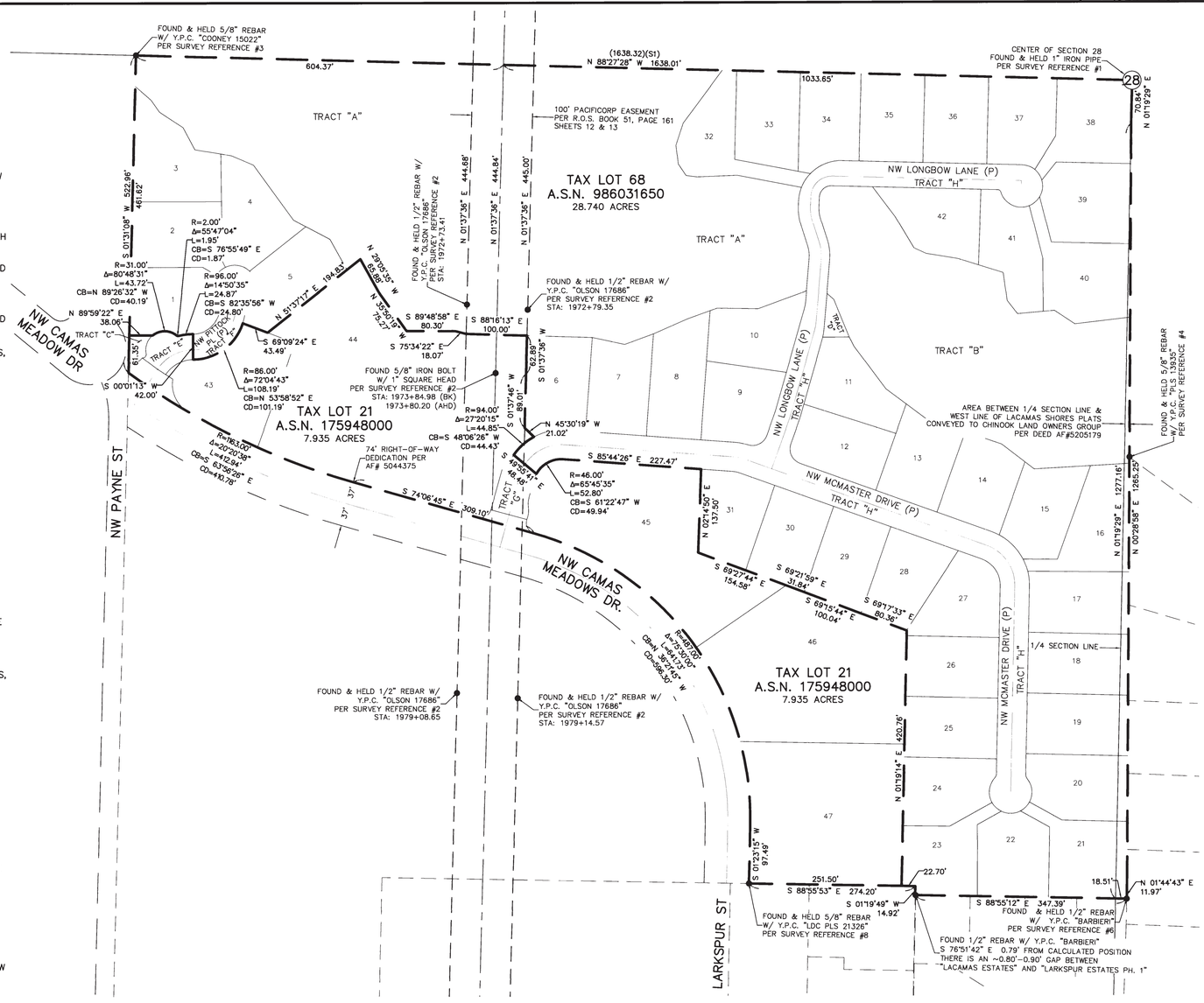
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4. NO FURTHER SHORT PLATTING OR SUBDIVIDING OF THE LOTS CONTAINED WITHIN THIS SUBDIVISION WILL BE PERMITTED.
5. THE LOTS IN THIS DEVELOPMENT ARE SUBJECT TO TRAFFIC IMPACT FEES AND FIRE IMPACT FEES. EACH NEW UNIT WILL BE SUBJECT TO THE PAYMENT OF APPROPRIATE IMPACT FEES AT THE TIME OF BUILDING PERMIT ISSUANCE OR AS OTHERWISE APPROVED BY THE CITY.
6. SHOULD ARCHAEOLOGICAL MATERIALS (E.G. CONES, SHELL, STONE TOOLS, BEADS, CERAMICS, OLD BOTTLES, HEARTH, ETC.) BE OBSERVED DURING PROJECT ACTIVITIES, ALL WORK IN THE IMMEDIATE VICINITY SHOULD STOP AND THE STATE DEPARTMENT OF ARCHAEOLOGY AND HISTORIC PRESERVATION (360-586-3534), THE CITY PLANNING OFFICE, AND THE AFFECTED TRIBE(S) SHOULD BE CONTACTED IMMEDIATELY. IF ANY HUMAN REMAINS ARE OBSERVED, ALL WORK SHOULD CEASE AND THE IMMEDIATE AREA SECURED. LOCAL LAW ENFORCEMENT, THE COUNTY MEDICAL EXAMINER (360-397-8405), STATE PHYSICAL ANTHROPOLOGIST, DEPARTMENT OF ARCHAEOLOGY, AND AFFECTED TRIBE(S) SHOULD BE CONTACTED IMMEDIATELY. COMPLIANCE WITH ALL APPLICABLE LAWS PERTAINING TO ARCHAEOLOGICAL RESOURCES (RCW 27.53, 27.44 AND WAC 25-48) AND HUMAN REMAINS (RCW 68.50) IS REQUIRED. FAILURE TO COMPLY WITH THIS REQUIREMENT COULD CONSTITUTE A CLASS C FELONY.

TRACT & EASEMENT NOTES:

1. TRACTS "A" & "B" ARE WETLAND TRACTS TO BE OWNED AND MAINTAINED BY THE HOMEOWNER'S ASSOCIATION. THE WETLAND TRACTS SHALL REMAIN IN THEIR NATURAL STATE UNLESS OTHERWISE APPROVED BY THE CITY OF CAMAS.
2. RIGHT OF ENTRY SHALL BE GRANTED FOR PUBLIC ACCESS TO THE TRAIL SYSTEM ACROSS TRACTS "A", "B", "E", "F" AND "G".
3. MAINTENANCE OF THE TRAIL SYSTEM LOCATED IN TRACTS "A" & "B" SHALL BE THE RESPONSIBILITY OF THE HOMEOWNER'S ASSOCIATION.
4. TRACTS "C" & "D" ARE OPEN SPACE TRACTS TO BE OWNED AND MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.
5. TRACTS "E", "F", "G" AND "H" (NW PITTOCK PLACE, NW MCMASTER DRIVE, AND NW LONGBOW LANE) ARE PRIVATE ROADS AND UTILITY TRACTS, GRANTED TO THE HOMEOWNER'S ASSOCIATION WITH THIS PLAT AND WILL BE OWNED, SHARED, AND MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.
6. THE STORMWATER SYSTEM IN ITS ENTIRETY SHALL BE OWNED AND MAINTAINED BY THE HOMEOWNER'S ASSOCIATION. RIGHT OF ENTRY SHALL BE GRANTED TO THE CITY OF CAMAS FOR INSPECTIONS.
7. PERMANENT AND CONTINUOUS FENCING SHALL BE INSTALLED ALONG THE OUTER EDGE OF THE WETLAND BUFFER OF TRACTS "A" AND "B" ABUTTING ALL LOTS AND TRACTS.
8. PERMANENT SIGNAGE SHALL BE INSTALLED ALONG THE OUTER EDGE OF THE WETLAND BUFFERS THAT READ, "WETLAND AREA – LEAVE IN ITS NATURAL STATE. IT IS ILLEGAL TO CUT, PRUNE, OR MOW IN THE AREA. CALL THE CITY OF CAMAS FOR INFORMATION".
9. A PUBLIC INGRESS AND EGRESS EASEMENT IS GRANTED OVER TRACTS "E" AND "F".

PUBLIC UTILITY & SIDEWALK EASEMENT:

A PUBLIC UTILITY EASEMENT IS HEREBY RESERVED OVER, UNDER AND UPON ALL DESIGNATED PRIVATE ROAD TRACTS AND/OR ROAD EASEMENTS, AND THE EXTERIOR 6.00 FEET OF ALL LOTS AND TRACTS LYING PARALLEL WITH AND ADJACENT TO ALL PUBLIC AND PRIVATE ROADS AND/OR EASEMENT FOR THE PURPOSE OF INSTALLING, CONSTRUCTING, RENEWING, OPERATING AND MAINTAINING OF ELECTRIC, TELEPHONE, TV, CABLE, WATER, SANITARY SEWER, AND OTHER UTILITIES AS NOTED. ALSO, A SIDEWALK EASEMENT IS RESERVED, AS NECESSARY TO COMPLY WITH ADA SLOPE REQUIREMENTS, UPON THE EXTERIOR SIX (6) FEET OF ALL LOTS AND TRACTS PARALLEL WITH AND ADJACENT TO THE PUBLIC ROAD FRONTAGES.



LEGEND:

- ● INDICATES MONUMENT FOUND AS NOTED
- ⊙ INDICATES 1/2" x 24" REBAR WITH YELLOW PLASTIC CAP INSCRIBED "RENTON 37535", SET
- ⊗ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535", SET
- \+ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535" SET AS A WITNESS CORNER AT THE EXTENSION OF LOT LINE IN THE CURB
- ○ INDICATES CALCULATED POSITION NOTHING SET

SURVEY REFERENCES:

1) SURVEY BOOK 49, PAGE 186
2) SURVEY BOOK 51, PAGE 161
3) SURVEY BOOK 49, PAGE 167
4) "LACAMAS SHORES – PHASE 6C" SUBDIVISION BOOK J, PAGE 531
5) "LACAMAS SHORES – PHASE 6D" SUBDIVISION BOOK J, PAGE 559
6) "LACAMAS ESTATES" SUBDIVISION BOOK 311, PAGE 414
7) "LARKSPUR ESTATES PH. 1" SUBDIVISION BOOK 311, PAGE 358
8) "LARKSPUR ESTATES PH. 2" SUBDIVISION BOOK 311, PAGE 401
9) SURVEY BOOK 53, PAGE 111
10) SURVEY BOOK 54, PAGE 024

10/31/17
DANIEL ADOLPH RENTON · STATE OF WASHINGTON · 37535 · REGISTERED PROFESSIONAL LAND SURVEYOR

100 50 0 100 150 200
SCALE 1 INCH = 100 FEET

BASIS OF BEARINGS: NAD83(2011)(EPOCH:2010.0000), WASHINGTON STATE PLANE COORDINATE SYSTEM SOUTH ZONE, U.S. SURVEY FEET

DEED REFERENCE (T.L. 68):

GRANTOR: CHINOOK LANDOWNWERS GROUP OF VANCOUVER, WASHINGTON, L.L.C.
GRANTEE: ESTATES AT PARKLANDS LLC
AFN: 5408391
DATE: MAY 31, 2017

DEED REFERENCE (T.L. 21):

GRANTOR: CHINOOK LANDOWNWERS GROUP OF VANCOUVER, WASHINGTON, L.L.C.
GRANTEE: ARCHERY HOLDINGS LLC
AFN: 5408393
DATE: MAY 31, 2017

MINISTER AND GLAESER SURVEYING, INC. MAKES NO WARRANTIES AS TO MATTERS OF UNWRITTEN TITLE SUCH AS ADVERSE POSSESSION, ACQUIESCENCE, ESTOPPLE, ETC.

A FIELD TRAVERSE WAS PERFORMED USING A FIVE SECOND TOTAL STATION. THE FIELD TRAVERSE MET THE MINIMUM STANDARDS FOR SURVEYS AS DESIGNATED IN WAC 332-130-090. ALL CORNERS NOTED AS FOUND WERE VISITED IN JUNE OF 2015.

CITY OF CAMAS, MAYOR:

APPROVED: _____
CITY OF CAMAS MAYOR — DATE

CITY OF CAMAS FINANCE DIRECTOR:

THERE ARE NO DELINQUENT SPECIAL ASSESSMENTS, AND THAT ALL SPECIAL ASSESSMENTS ON ANY OF THE PROPERTY THAT IS DEDICATED AS STREETS, ALLEYS OR FOR OTHER PUBLIC USE ARE PAID IN FULL.

ATTESTED BY: Cath Wilson Wehn
CITY OF CAMAS FINANCE DIRECTOR — DATE

CITY OF CAMAS COMMUNITY DEVELOPMENT:

APPROVED: _____
CITY OF CAMAS COMMUNITY DEVELOPMENT DIRECTOR, OR DESIGNEE — DATE

CITY OF CAMAS ENGINEER:

A) ALL IMPROVEMENTS HAVE BEEN INSTALLED OR FINANCIALLY SECURED IN ACCORDANCE WITH THE REQUIREMENTS OF THIS TITLE AND WITH THE PRELIMINARY PLAT APPROVAL;

B) ALL IMPROVEMENTS CAN OR WILL MEET CURRENT PUBLIC WORKS DRAWING STANDARDS FOR ROAD, UTILITY AND DRAINAGE CONSTRUCTION PLANS;

C) ORIGINAL AND REPRODUCIBLE MYLAR OR ELECTRONIC RECORDS IN A FORMAT APPROVED BY THE PUBLIC WORKS DIRECTOR OR DESIGNEE AND CERTIFIED BY THE DESIGNING ENGINEER AS BEING "AS CONSTRUCTED" HAVE BEEN SUBMITTED OR FINANCIALLY SECURED FOR CITY RECORDS.

APPROVED: _____ 11/27/17
CITY OF CAMAS ENGINEER — DATE

FIRE CHIEF:

APPROVED: _____ 11/22/17
FIRE CHIEF, OR DESIGNEE — DATE

CLARK COUNTY ASSESSOR:

THIS PLAT MEETS THE REQUIREMENTS OF R.C.W 58.17.170, LAWS OF WASHINGTON, TO BE KNOWN AS "ESTATES AT THE ARCHERY", PLAT NO. _____ IN THE COUNTY OF CLARK, STATE OF WASHINGTON.

Peter VanNortwick By Julie Olson 11/27/17
COUNTY ASSESSOR — DATE

CLARK COUNTY AUDITOR:

FILED FOR RECORD THIS 27th DAY OF November, 2017
IN BOOK 311 OF PLATS, AT PAGE 924
AT THE REQUEST OF ESTATES AT PARKLANDS, LLC & ARCHERY HOLDINGS, LLC
AUDITOR'S RECEIVING NO. 5410554

Greg Kimsey by Nadine Ungaarden
DEPUTY/COUNTY AUDITOR

SURVEYOR'S CERTIFICATE:

I HEREBY CERTIFY THAT THIS PLAT AS SHOWN IS A TRUE RETURN FROM THE FIELD AND THAT THE DELINEATION IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

_____ 10/31/17
DANIEL A. RENTON, PROFESSIONAL LAND SURVEYOR — DATE
PLS NO. 37535

MINISTER–GLAESER SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694–3313

JOB NO. 15-185
DATE: 10-31-17
CALC BY: DLS
DRAWN BY: CSA
CHECKED BY: DAR
FILE: 15185.DWG

BK 311 PG 924

This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.

BK 311 PG 924

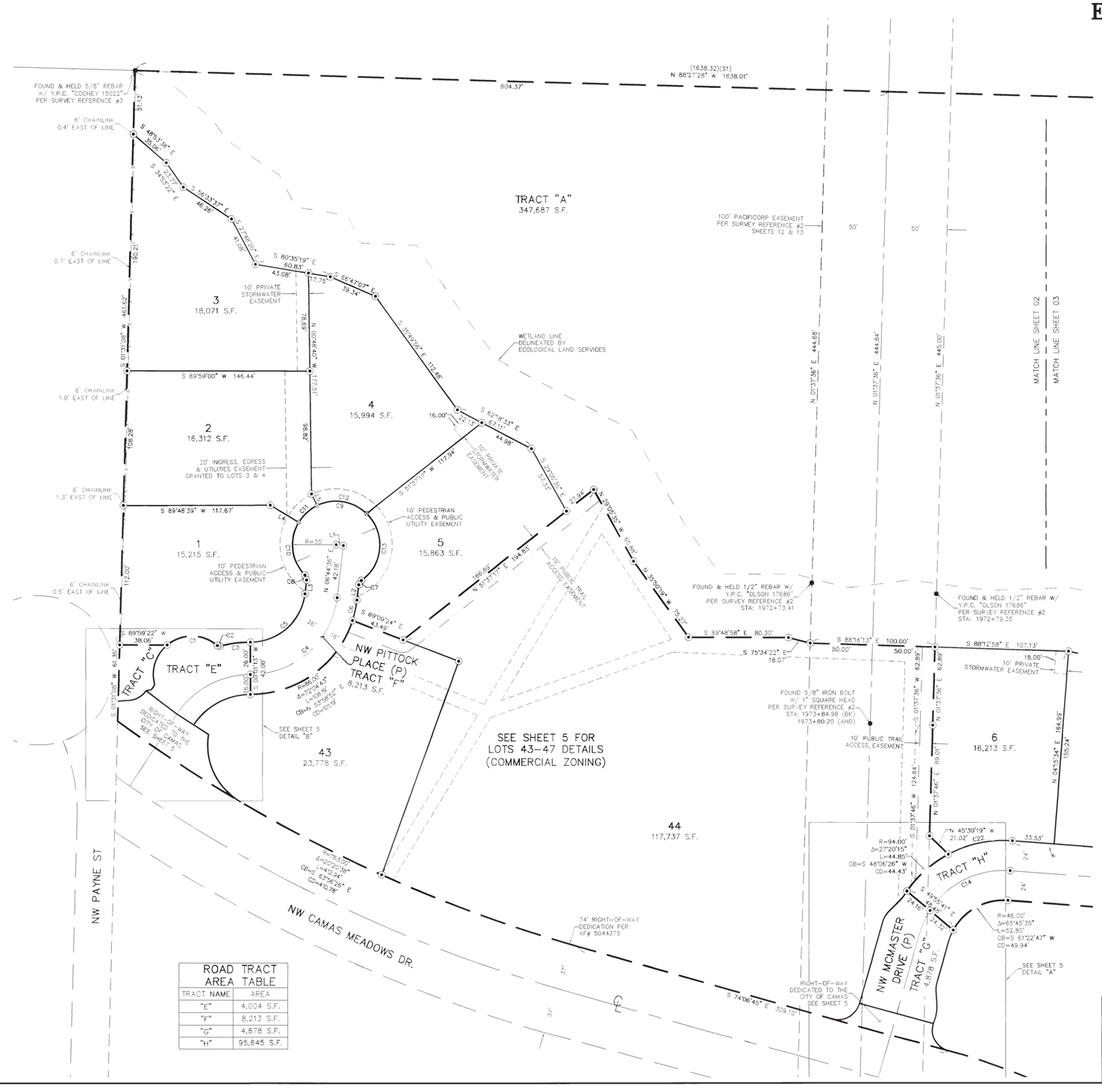
ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 2 OF 6

CURVE TABLE SHEETS 2–4					
CURVE	RADIUS	DELTA	ARC DIST.	CHORD BEARING	CHORD DIST.
C1	31.00'	80°48'31"	43.72'	N 89°26'32" W	40.19'
C2	2.00'	55°47'04"	1.95'	S 76°55'49" E	1.87'
C3	96.00'	14°50'35"	24.87'	S 82°35'56" W	24.80'
C4	70.00'	83°16'37"	101.74'	N 48°22'55" E	93.02'
C5	44.00'	83°16'37"	63.95'	N 48°22'55" E	58.47'
C6	86.00'	11°11'55"	16.81'	N 12°20'33" E	16.78'
C7	5.00'	47°58'14"	4.19'	S 30°43'43" W	4.07'
C8	5.00'	50°54'50"	4.44'	N 18°42'49" W	4.30'
C9	35.00'	278°53'04"	170.36'	N 84°43'42" W	45.52'
C10	35.00'	75°06'12"	45.88'	S 06°37'08" E	42.66'
C11	35.00'	33°12'11"	20.28'	S 47°32'04" W	20.00'
C12	35.00'	70°05'45"	42.82'	N 80°48'58" W	40.20'
C13	35.00'	100°28'55"	61.38'	N 04°28'22" E	53.81'
C14	70.00'	61°45'45"	75.46'	S 63°22'42" W	71.86'
C15	70.00'	15°29'29"	18.93'	N 77°59'42" W	18.87'
C16	70.00'	71°33'54"	87.43'	N 34°28'00" W	81.86'
C17	100.00'	3°49'07"	6.66'	N 17°50'29" E	6.66'
C18	70.00'	11°06'06"	13.56'	N 10°22'52" E	13.54'
C19	70.00'	22°35'32"	27.60'	N 06°27'57" W	27.42'
C20	70.00'	20°06'55"	24.58'	S 07°42'16" E	24.45'
C21	35.00'	89°09'49"	54.47'	S 46°56'06" W	49.13'
C22	94.00'	32°29'00"	53.29'	S 78°01'03" W	52.58'
C23	46.00'	15°29'29"	12.44'	N 77°59'42" W	12.40'
C24	94.00'	13°34'37"	22.27'	N 78°57'07" W	22.22'
C25	25.00'	88°05'09"	38.43'	N 63°47'37" E	34.76'
C26	25.00'	90°00'00"	39.27'	S 25°14'57" E	35.36'
C27	46.00'	71°33'54"	57.46'	N 34°28'00" W	53.79'
C28	94.00'	71°33'56"	117.41'	N 34°28'00" W	109.93'
C29	94.00'	8°34'43"	14.07'	N 65°57'36" W	14.06'
C30	94.00'	34°32'25"	56.67'	N 44°24'02" W	55.81'
C31	94.00'	13°05'07"	21.47'	N 20°35'16" W	21.42'
C32	94.00'	15°21'40"	25.20'	N 06°21'52" W	25.13'
C33	10.00'	40°49'14"	7.12'	S 19°05'40" E	6.97'
C34	10.00'	41°01'53"	7.16'	N 21°49'53" E	7.01'
C35	35.00'	261°51'07"	159.96'	S 88°34'44" E	52.89'
C36	35.00'	67°38'20"	41.32'	N 05°41'07" W	38.96'
C37	35.00'	34°38'19"	21.16'	N 45°27'13" E	20.84'
C38	35.00'	53°04'46"	32.42'	N 89°18'46" E	31.28'
C39	35.00'	34°52'34"	21.30'	S 46°42'35" E	20.98'
C40	35.00'	71°37'08"	43.75'	S 06°32'16" W	40.96'
C41	74.00'	3°49'07"	4.93'	N 17°50'29" E	4.93'
C42	116.00'	3°49'07"	7.73'	N 17°50'29" E	7.73'
C43	70.00'	11°06'06"	13.56'	N 10°22'52" E	13.54'
C44	85.00'	11°06'06"	16.47'	N 10°22'52" E	16.44'
C45	50.00'	22°35'32"	19.72'	N 06°27'57" W	19.59'
C46	84.00'	22°35'32"	33.12'	N 06°27'57" W	32.91'
C47	90.00'	20°06'55"	31.60'	S 07°42'16" E	31.43'
C48	56.00'	20°06'55"	19.66'	S 07°42'16" E	19.56'
C49	70.00'	89°09'49"	108.93'	S 46°56'06" W	98.27'
C50	20.00'	89°09'49"	31.12'	S 46°56'06" W	28.08'
C51	70.00'	19°22'58"	23.68'	S 12°02'41" W	23.57'
C52	70.00'	22°12'38"	27.14'	S 32°50'28" W	26.97'
C53	70.00'	47°34'13"	58.12'	S 67°43'54" W	56.46'
C54	5.00'	72°32'33"	6.33'	N 52°12'44" W	5.92'
C55	35.00'	252°32'33"	154.27'	N 37°47'16" E	56.44'
C56	35.00'	96°03'16"	58.68'	S 63°58'05" E	52.04'
C57	35.00'	37°14'17"	22.75'	N 49°23'08" E	22.35'
C58	35.00'	46°31'43"	28.42'	N 07°30'08" E	27.65'
C59	35.00'	34°56'47"	21.35'	N 33°14'07" W	21.02'
C60	35.00'	37°46'30"	23.08'	N 69°35'45" W	22.66'
C61	85.00'	1°57'15"	2.90'	N 14°57'18" E	2.90'
C62	85.00'	9°08'51"	13.57'	N 09°24'15" E	13.56'

LINE TABLE SHEETS 2–4		
LINE	BEARING	DISTANCE
L1	S 83°15'24" E	5.78'
L2	N 06°44'36" E	12.46'
L3	S 06°44'36" W	11.13'
L4	N 59°04'02" W	26.51'
L5	S 25°51'51" E	10.23'
L6	N 17°45'43" W	36.12'
L7	N 02°21'12" E	17.47'
L8	S 01°31'00" W	9.00'

ROAD TRACT AREA TABLE	
TRACT NAME	AREA
"E"	4,004 S.F.
"F"	8,213 S.F.
"G"	4,878 S.F.
"H"	95,645 S.F.



SURVEY REFERENCES:

1) SURVEY BOOK 49, PAGE 186
2) SURVEY BOOK 51, PAGE 161
3) SURVEY BOOK 49, PAGE 167
4) "LACAMAS SHORES – PHASE 6C" SUBDIVISION BOOK J, PAGE 531
5) "LACAMAS SHORES – PHASE 6D" SUBDIVISION BOOK J, PAGE 559
6) "LACAMAS ESTATES" SUBDIVISION BOOK 311, PAGE 414
7) "LARKSPUR ESTATES PH. 1" SUBDIVISION BOOK 311, PAGE 358
8) "LARKSPUR ESTATES PH. 2" SUBDIVISION BOOK 311, PAGE 401
9) SURVEY BOOK 53, PAGE 111
10) SURVEY BOOK 54, PAGE 024

DEED REFERENCE:

GRANTOR: CHINOOK LANDOWNWERS GROUP OF VANCOUVER, WASHINGTON, L.L.C.
GRANTEE: ESTATES AT PARKLANDS LLC
AFN: 5408391
DATE: MAY 31, 2017

LEGEND:

- ● INDICATES MONUMENT FOUND AS NOTED
- ⊙ INDICATES 1/2" x 24" REBAR WITH YELLOW PLASTIC CAP INSCRIBED "RENTON 37535", SET
- ⊗ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535", SET
- \+ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535" SET AS A WITNESS CORNER AT THE EXTENSION OF LOT LINE IN THE CURB
- ○ INDICATES CALCULATED POSITION NOTHING SET

BASIS OF BEARINGS: NAD83(2011)(EPOCH:2010.0000), WASHINGTON STATE PLANE COORDINATE SYSTEM SOUTH ZONE, U.S. SURVEY FEET

10/31/17

DANIEL ADOLPH RENTON — STATE OF WASHINGTON — 37535 — REGISTERED PROFESSIONAL LAND SURVEYOR

40 20 0 40 60 80
SCALE 1 INCH = 40 FEET

MINISTER–GLAESER SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694–3313

JOB NO. 15–185
DATE: 10–31–17
CALC BY: DLS
DRAWN BY: CSA
CHECKED BY: DAR
FILE: 15185.DWG

BK 311 PG 924

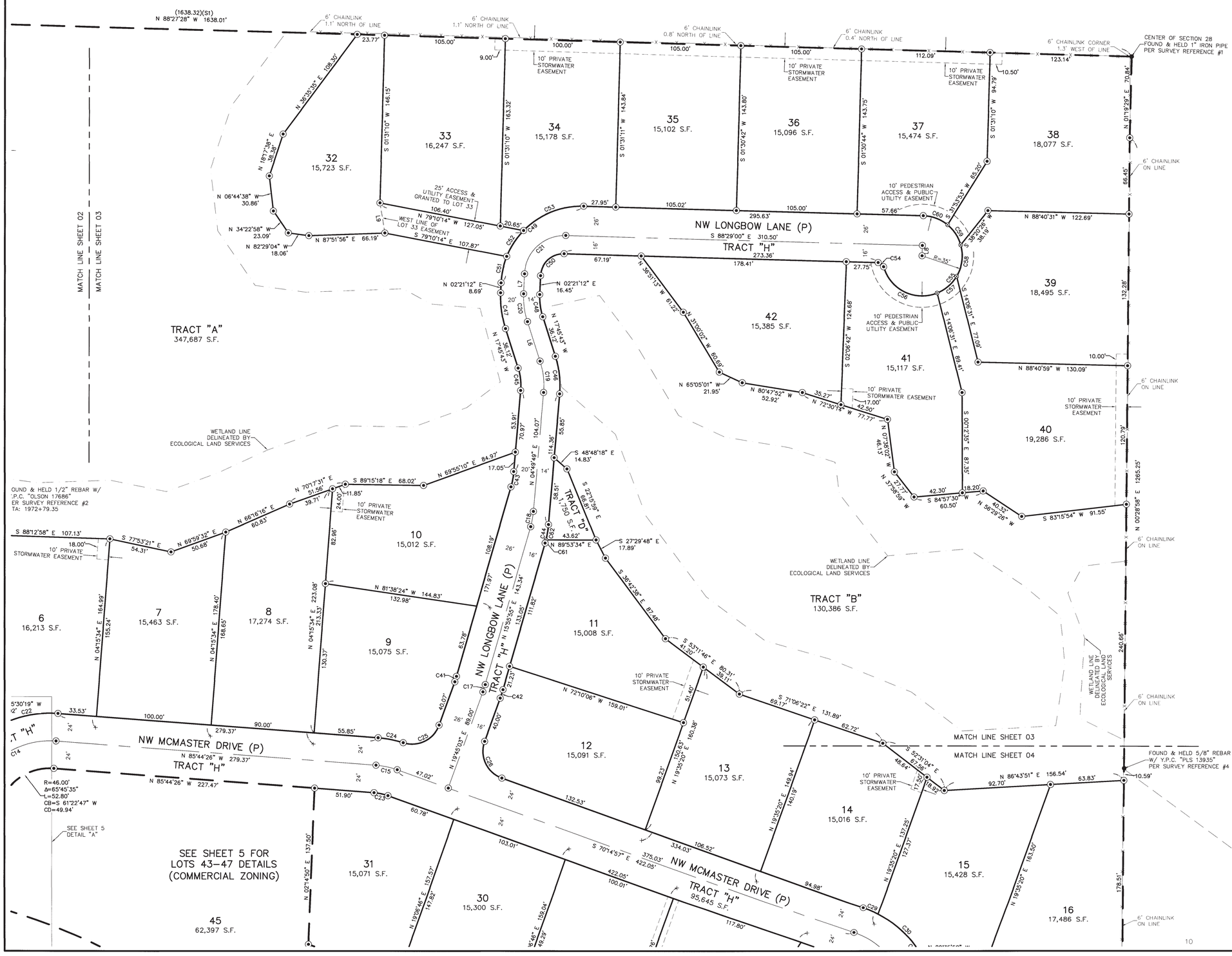
2/6

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BK 311 PG 924

ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 3 OF 6



SURVEY REFERENCES:

1) SURVEY BOOK 49, PAGE 186
2) SURVEY BOOK 51, PAGE 161
3) SURVEY BOOK 49, PAGE 167
4) "LACAMAS SHORES – PHASE 6C" SUBDIVISION BOOK J, PAGE 531
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- \+ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535" SET AS A WITNESS CORNER AT THE EXTENSION OF LOT LINE IN THE CURB
- ○ INDICATES CALCULATED POSITION NOTHING SET

10/31/17
DANIEL ADOLPH RENTON
STATE OF WASHINGTON
37535
REGISTERED
PROFESSIONAL LAND SURVEYOR

MINISTER–GLAESER SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694–3313

JOB NO. 15–185
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DRAWN BY: CSA
CHECKED BY: DAR
FILE: 15185.DWG

BK 311 PG 924

3/6

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BK 311 PG 924

ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 4 OF 6

NW MCMASTER DRIVE (P)
TRACT "H"
95,645 S.F.
N 85°44'26" W 279.37'
N 85°44'26" W 227.47'
46.00'
55°45'35"
52.80'
=S 61°22'47" W
=49.94'
SEE SHEET 5
DETAIL "A"
SEE SHEET 5 FOR
LOTS 43–47 DETAILS
(COMMERCIAL ZONING)
NW CAMAS MEADOWS DR.
NW LARKSPUR ST
74' RIGHT-OF-WAY
DEDICATION PER
AF# 5044375
FOUND & HELD 5/8" REBAR
W/ Y.P.C. "LDC PLS 21326"
PER SURVEY REFERENCE #8
FOUND & HELD 5/8" REBAR
W/ Y.P.C. "PLS 13935"
PER SURVEY REFERENCE #4
FOUND 5/8" REBAR W/
"PLS 13935" Y.P.C.
FOUND 1/2" REBAR W/ Y.P.C. "BARBIERI"
S 76°51'42" E 0.79' FROM CALCULATED POSITION
THERE IS AN ~0.80'~0.90' GAP BETWEEN
"LACAMAS ESTATES" AND "LARKSPUR ESTATES PH. 1"
FOUND & HELD 1/2" REBAR
W/ Y.P.C. "BARBIERI"
PER SURVEY REFERENCE #6
MATCH LINE SHEET 03
MATCH LINE SHEET 04
10' PRIVATE STORMWATER EASEMENT
10' PEDESTRIAN ACCESS & PUBLIC UTILITY EASEMENT
6' CHAINLINK ON LINE
6' BOARD FENCE 0.4' SOUTH OF LINE
6' CHAINLINK 1.2' SOUTH OF LINE
4' HOG WIRE
"LACAMAS SHORES PHASE 6C"
"LACAMAS SHORES PHASE 6D"
"LARKSPUR ESTATES PHASE 2"
"LARKSPUR ESTATES PHASE 1"
"LACAMAS ESTATES"
TRACT "G"
TRACT "A"

12	15,091 S.F.	
13	15,073 S.F.	
14	15,016 S.F.	
15	15,428 S.F.	
16	17,486 S.F.	
17	16,663 S.F.	
18	16,477 S.F.	
19	16,622 S.F.	
20	16,805 S.F.	
21	17,359 S.F.	
22	15,456 S.F.	
23	15,104 S.F.	
24	15,104 S.F.	
25	15,196 S.F.	
26	15,195 S.F.	
27	15,052 S.F.	
28	15,039 S.F.	
29	15,015 S.F.	
30	15,300 S.F.	
31	15,071 S.F.	
45	62,397 S.F.	
46	68,047 S.F.	
47	59,602 S.F.	

SURVEY REFERENCES:

1) SURVEY BOOK 49, PAGE 186
2) SURVEY BOOK 51, PAGE 161
3) SURVEY BOOK 49, PAGE 167
4) "LACAMAS SHORES – PHASE 6C" SUBDIVISION BOOK J, PAGE 531
5) "LACAMAS SHORES – PHASE 6D" SUBDIVISION BOOK J, PAGE 559
6) "LACAMAS ESTATES" SUBDIVISION BOOK 311, PAGE 414
7) "LARKSPUR ESTATES PH. 1" SUBDIVISION BOOK 311, PAGE 358
8) "LARKSPUR ESTATES PH. 2" SUBDIVISION BOOK 311, PAGE 401
9) SURVEY BOOK 53, PAGE 111
10) SURVEY BOOK 54, PAGE 024

DEED REFERENCE:

GRANTOR: CHINOOK LANDOWNERS GROUP OF VANCOUVER, WASHINGTON, L.L.C.
GRANTEE: ESTATES AT PARKLANDS LLC
AFN: 5408391
DATE: MAY 31, 2017

LEGEND:

- ● INDICATES MONUMENT FOUND AS NOTED
- ⊙ INDICATES 1/2" x 24" REBAR WITH YELLOW PLASTIC CAP INSCRIBED "RENTON 37535", SET
- ⊗ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535", SET
- \+ INDICATES ROCK NAIL WITH BRASS WASHER INSCRIBED "PLS 37535" SET AS A WITNESS CORNER AT THE EXTENSION OF LOT LINE IN THE CURB
- ○ INDICATES CALCULATED POSITION NOTHING SET

BASIS OF BEARINGS: NAD83(2011)(EPOCH:2010.0000), WASHINGTON STATE PLANE COORDINATE SYSTEM SOUTH ZONE, U.S. SURVEY FEET

10/31/17
DANIEL ADOLPH RENTON
STATE OF WASHINGTON
37535
REGISTERED
PROFESSIONAL LAND SURVEYOR

40 20 0 40 60 80
SCALE 1 INCH = 40 FEET

MINISTER–GLAESER SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694–3313

JOB NO. 15–185
DATE: 10–31–17
CALC BY: DLS
DRAWN BY: CSA
CHECKED BY: DAR
FILE: 15185.DWG

BK 311 PG 924

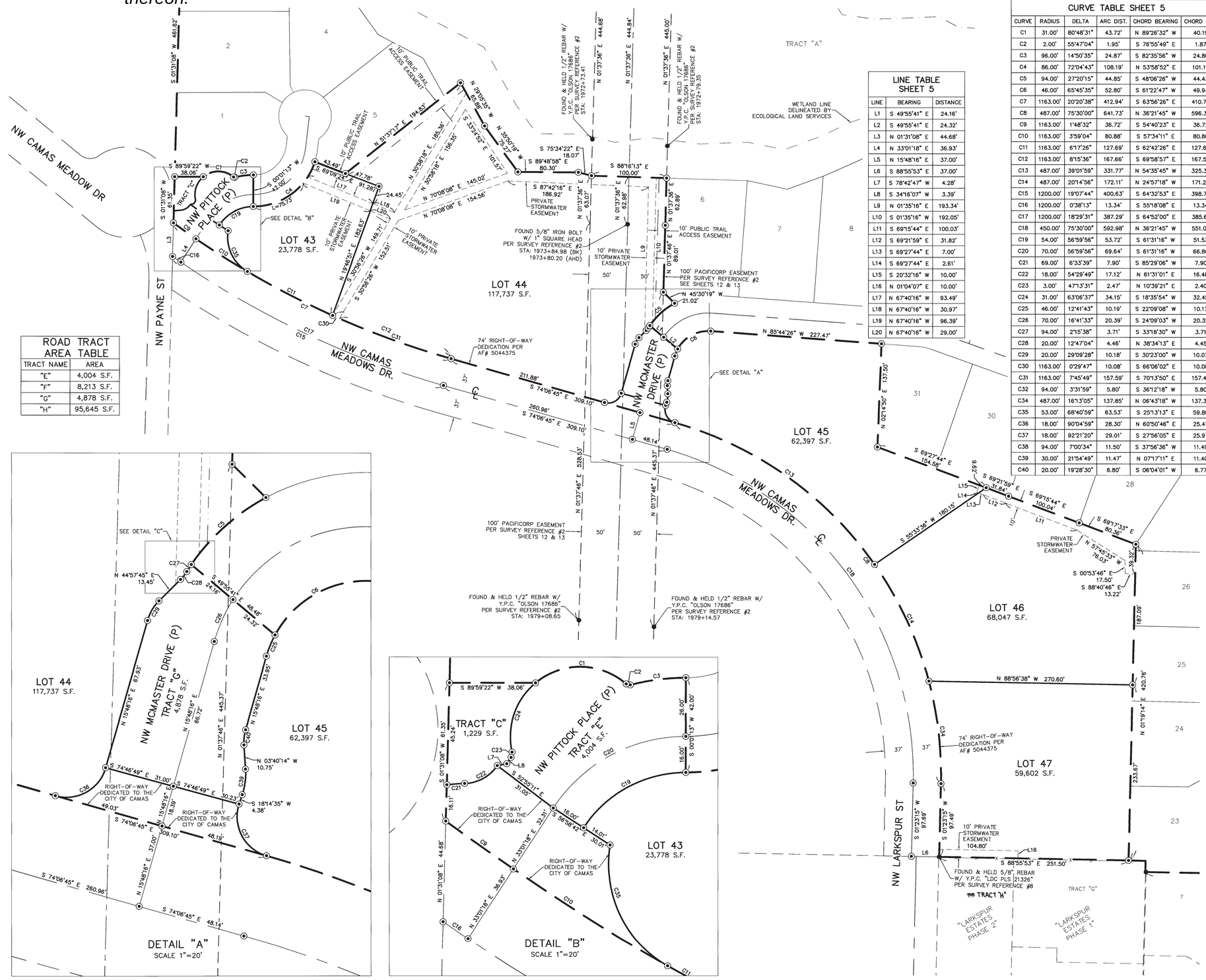
4/6

This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.

BK311 PG 924

ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 5 OF 6



ROAD TRACT AREA TABLE	
TRACT NAME	AREA
"E"	4,004 S.F.
"F"	8,213 S.F.
"G"	4,878 S.F.
"H"	95,645 S.F.

LINE TABLE SHEET 5		
LINE	BEARING	DISTANCE
L1	S 49°55'41" E	24.16'
L2	S 49°55'41" E	24.32'
L3	N 01°31'08" E	44.68'
L4	N 33°01'18" E	36.93'
L5	N 15°48'16" E	37.00'
L6	S 88°55'53" E	37.00'
L7	S 78°42'47" W	4.28'
L8	S 34°16'07" W	3.39'
L9	N 01°35'16" E	193.34'
L10	S 01°35'16" W	192.05'
L11	S 69°15'44" E	100.03'
L12	S 69°21'59" E	31.82'
L13	S 69°27'44" E	7.00'
L14	S 69°27'44" E	2.61'
L15	S 20°32'16" W	10.00'
L16	N 01°04'07" E	10.00'
L17	N 67°40'16" W	93.49'
L18	N 67°40'16" W	30.97'
L19	N 67°40'16" W	96.39'
L20	N 67°40'16" W	29.00'

CURVE TABLE SHEET 5					
CURVE	RADIUS	DELTA	ARC DIST.	CHORD BEARING	CHORD DIST.
C1	31.00'	80°48'31"	43.72'	N 89°26'32" W	40.19'
C2	2.00'	55°47'04"	1.95'	S 76°55'49" E	1.87'
C3	96.00'	14°50'35"	24.87'	S 82°35'56" W	24.80'
C4	86.00'	72°04'43"	108.19'	N 53°58'52" E	101.19'
C5	94.00'	27°20'15"	44.85'	S 48°06'26" W	44.43'
C6	46.00'	65°45'35"	52.80'	S 61°22'47" W	49.94'
C7	1163.00'	20°20'38"	412.94'	S 63°56'26" E	410.78'
C8	487.00'	75°30'00"	641.73'	N 36°21'45" W	596.30'
C9	1163.00'	1°48'32"	36.72'	S 54°40'23" E	36.72'
C10	1163.00'	3°59'04"	80.88'	S 57°34'11" E	80.86'
C11	1163.00'	6°17'26"	127.69'	S 62°42'26" E	127.62'
C12	1163.00'	8°15'36"	167.66'	S 69°58'57" E	167.52'
C13	487.00'	39°01'59"	331.77'	N 54°35'45" W	325.39'
C14	487.00'	20°14'56"	172.11'	N 24°57'18" W	171.22'
C15	1200.00'	19°07'44"	400.63'	S 64°32'53" E	398.77'
C16	1200.00'	0°38'13"	13.34'	S 55°18'08" E	13.34'
C17	1200.00'	18°29'31"	387.29'	S 64°52'00" E	385.61'
C18	450.00'	75°30'00"	592.98'	N 36°21'45" W	551.00'
C19	54.00'	56°59'56"	53.72'	S 61°31'16" W	51.53'
C20	70.00'	56°59'56"	69.64'	S 61°31'16" W	66.80'
C21	69.00'	6°33'39"	7.90'	S 85°29'06" W	7.90'
C22	18.00'	54°29'49"	17.12'	N 61°31'01" E	16.48'
C23	3.00'	47°13'31"	2.47'	N 10°39'21" E	2.40'
C24	31.00'	63°06'37"	34.15'	S 18°35'54" W	32.45'
C25	46.00'	12°41'43"	10.19'	S 22°09'08" W	10.17'
C26	70.00'	16°41'33"	20.39'	S 24°09'03" W	20.32'
C27	94.00'	2°15'38"	3.71'	S 33°18'30" W	3.71'
C28	20.00'	12°47'04"	4.46'	N 38°34'13" E	4.45'
C29	20.00'	29°09'28"	10.18'	S 30°23'00" W	10.07'
C30	1163.00'	0°29'47"	10.08'	S 66°06'02" E	10.08'
C31	1163.00'	7°45'49"	157.59'	S 70°13'50" E	157.47'
C32	94.00'	3°31'59"	5.80'	S 36°12'18" W	5.80'
C34	487.00'	16°13'05"	137.85'	N 06°43'18" W	137.39'
C35	53.00'	68°40'59"	63.53'	S 25°13'13" E	59.80'
C36	18.00'	90°04'59"	28.30'	N 60°50'46" E	25.47'
C37	18.00'	92°21'20"	29.01'	S 27°56'05" E	25.97'
C38	94.00'	7°00'34"	11.50'	S 37°56'36" W	11.49'
C39	30.00'	21°54'49"	11.47'	N 07°17'11" E	11.40'
C40	20.00'	19°28'30"	6.80'	S 06°04'01" W	6.77'

SURVEY REFERENCES:

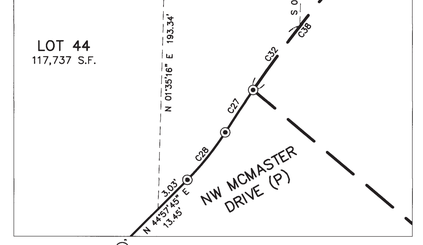
1) SURVEY BOOK 49, PAGE 186
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DEED REFERENCE:

GRANTOR: CHINOOK LANDOWNWERS GROUP OF VANCOUVER, WASHINGTON, L.L.C.
GRANTEE: ARCHERY HOLDINGS LLC
AFN: 5408393
DATE: MAY 31, 2017

LEGEND:

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BASIS OF BEARINGS: NAD83(2011)(EPOCH:2010.0000), WASHINGTON STATE PLANE COORDINATE SYSTEM SOUTH ZONE. U.S. SURVEY FEET

10/31/17

DANIEL ADOLPH RENTON — STATE OF WASHINGTON — 37535 — REGISTERED PROFESSIONAL LAND SURVEYOR

60 30 0 60 90 120
SCALE 1 INCH = 60 FEET

MINISTER–GLAESER SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694–3313

JOB NO. 15–185
DATE: 10–31–17
CALC BY: DLS
DRAWN BY: CSA
CHECKED BY: DAR
FILE: 15185.DWG

BK 311 PG924

5/6

This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land, and is not a survey of the land depicted. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances, location of easements, acreage or other matters shown thereon.

BK 311 PG 924

ESTATES AT THE ARCHERY

PRELIMINARY APPROVED AS
"PARKLANDS AT CAMAS MEADOWS"
A SUBDIVISION IN A PORTION OF
THE NW 1/4 OF THE SE 1/4 AND THE
NW 1/4 AND THE NE 1/4 OF THE SW 1/4
OF SECTION 28,
T. 2 N., R. 3 E., W.M.
CITY OF CAMAS, CLARK COUNTY, WA
SHEET 6 OF 6

BUILDING SETBACKS DIAGRAM

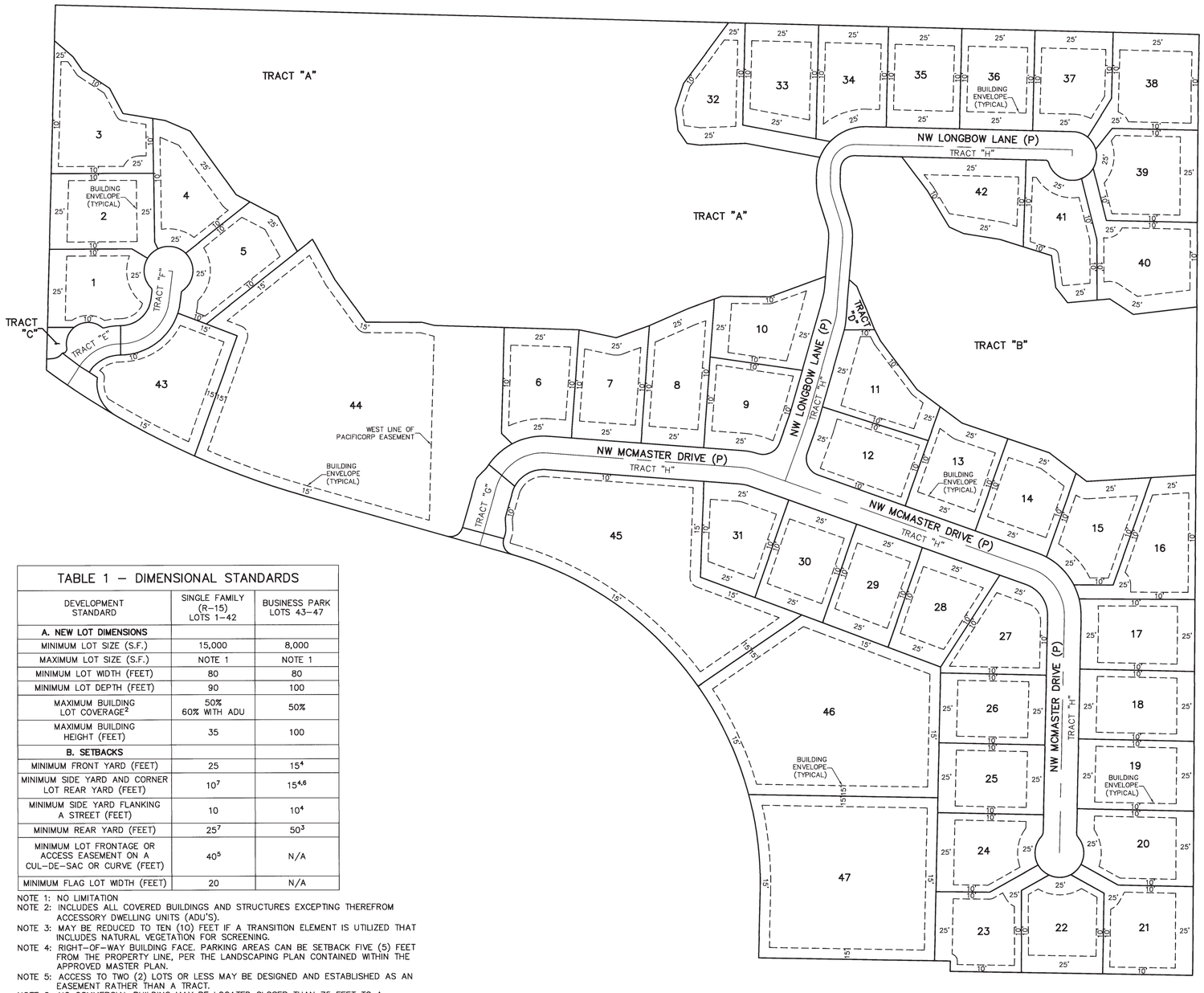


TABLE 1 – DIMENSIONAL STANDARDS		
DEVELOPMENT STANDARD	SINGLE FAMILY (R–15) LOTS 1–42	BUSINESS PARK LOTS 43–47
A. NEW LOT DIMENSIONS		
MINIMUM LOT SIZE (S.F.)	15,000	8,000
MAXIMUM LOT SIZE (S.F.)	NOTE 1	NOTE 1
MINIMUM LOT WIDTH (FEET)	80	80
MINIMUM LOT DEPTH (FEET)	90	100
MAXIMUM BUILDING LOT COVERAGE[2]	50% 60% WITH ADU	50%
MAXIMUM BUILDING HEIGHT (FEET)	35	100
B. SETBACKS		
MINIMUM FRONT YARD (FEET)	25	15[4]
MINIMUM SIDE YARD AND CORNER LOT REAR YARD (FEET)	10[7]	15[4,6]
MINIMUM SIDE YARD FLANKING A STREET (FEET)	10	10[4]
MINIMUM REAR YARD (FEET)	25[7]	50[3]
MINIMUM LOT FRONTAGE OR ACCESS EASEMENT ON A CUL–DE–SAC OR CURVE (FEET)	40[5]	N/A
MINIMUM FLAG LOT WIDTH (FEET)	20	N/A

NOTE 1: NO LIMITATION
NOTE 2: INCLUDES ALL COVERED BUILDINGS AND STRUCTURES EXCEPTING THEREFROM ACCESSORY DWELLING UNITS (ADU'S).
NOTE 3: MAY BE REDUCED TO TEN (10) FEET IF A TRANSITION ELEMENT IS UTILIZED THAT INCLUDES NATURAL VEGETATION FOR SCREENING.
NOTE 4: RIGHT–OF–WAY BUILDING FACE. PARKING AREAS CAN BE SETBACK FIVE (5) FEET FROM THE PROPERTY LINE, PER THE LANDSCAPING PLAN CONTAINED WITHIN THE APPROVED MASTER PLAN.
NOTE 5: ACCESS TO TWO (2) LOTS OR LESS MAY BE DESIGNED AND ESTABLISHED AS AN EASEMENT RATHER THAN A TRACT.
NOTE 6: NO COMMERCIAL BUILDING MAY BE LOCATED CLOSER THAN 75 FEET TO A RESIDENTIAL LOT EXISTING ON THE EFFECTIVE DATE OF THIS AGREEMENT.
NOTE 7: FIVE (5) FEET FOR A.D.U. OR ACCESSORY BUILDINGS.

BASIS OF BEARINGS: NAD83(2011)(EPOCH:2010.0000), WASHINGTON STATE PLANE COORDINATE SYSTEM SOUTH ZONE, U.S. SURVEY FEET

10/31/17

DANIEL ADOLPH RENTON — STATE OF WASHINGTON — 37535 — REGISTERED PROFESSIONAL LAND SURVEYOR

80 40 0 80 120 160
SCALE 1 INCH = 80 FEET

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6/6

5473794 CCR
Total Pages: 22 Rec Fee: $95.00
eRecorded in Clark County, WA 12/22/2017 03:14 PM
STEWART TITLE - VANCOUVER MAIN
SIMPLIFILE LC E-RECORDING

RECORDING REQUESTED BY
AND WHEN RECORDED RETURN TO:

Parklands HOA
4225 NE St James Rd
Vancouver, WA 98663

Unofficial Document

Grantor: Estates at Parklands, a Washington limited liability company

Grantee: Estates of Parklands, a Washington limited liability company

Abbrev. Legal/Lot Nos: Lots 1 through 42, ESTATES AT THE ARCHERY in Vol. 311 of Plats, page 924

Assessor Tax Parcel Nos: 986043866, 986043867, 986043868, 986043869, 986043870, 986043871, 986043872, 986043873, 986043874, 986043875, 986043876, 986043877, 986043878, 986043879, 986043880, 986043881, 986043882, 986043883, 986043884, 986043885, 986043886, 986043887, 986043888, 98643889, 986043890 986043891, 986043892, 986043893, 986043894, 986043895, 986043896, 986043897, 986043898, 986043899, 986043900, 986043901, 986043902, 986043903, 986043904 986043905, 986043906 986043907, 986043908, 986043909, 986043910, 986043911, 986043912, 986043918, 986043919, 906043920,

Other Reference Nos: 5468291 MULTI

AMENDED & RESTATED

DECLARATION OF PROTECTIVE COVENANTS, CONDITIONS, RESTRICTIONS AND EASEMENTS FOR PARKLANDS AT CAMAS

MEADOWS RESIDENTIAL SUBDIVISION (a portion of the ESTATES AT THE ARCHERY)

THIS DECLARATION is made this 22nd day of December 2017 by Estates at Parklands LLC, a Washington limited liability company ("Declarant")

WITNESSETH:

WHEREAS, Declarant is the owner of certain real property in the City of Camas, County of Clark, State of Washington, described as the plat of the Estates at the Archery, which includes Parklands at Camas Meadows Subdivision, recorded as Clark County Auditor File No. 5465549/Bk 311 Pg 924 (the "Plat"). The Plat also includes the Archery at Camas Meadows Business Park.

This Declaration of Protective Covenants, Conditions, Restrictions and Easements for Parklands at Camas Meadows Residential Subdivision ("Declaration") applies to the residential portion of the Plat, legally described on Exhibit "A", attached hereto and incorporated herein by reference ("Subdivision"). This Declaration is subject to the terms and conditions of the Plat, which is hereby incorporated by reference.

Declarant hereby declares that all of the properties in the Subdivision shall be held, sold and conveyed subject to the following easements, covenants, conditions, and restrictions which are for the purpose of the protection of peace and property values of the lots and dwellings contained in the Subdivision.

This Declaration is subject to the terms and conditions of the Plat, which are hereby incorporated herein by reference. Declarant hereby declares that all of property in the Subdivision shall be sold and conveyed subject to this Declaration for the purpose of protecting the value and desirability of the Subdivision, shall run with the land, and be binding on all parties their successors and heirs, having any right, title or interest in the Subdivision. This Declaration is recorded in connection with the creation of the Plat. A further purpose of this Declaration shall be to provide adequate funds for the repair and maintenance of common area, and improvements thereon, for the continued use and benefit of the lot owners thereof. This Declaration touches and concerns the land and shall run with the land for as long as common area and improvements exist to serve one or more of the lots in the Subdivision.

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ARTICLE I

DEFINITIONS

Section 1. "Architectural Review Committee" means the Declarant Estates at Parklands LLC, its successors and assigns, agents and/or representatives, which will implement architectural and landscape standards for all improvements within the Subdivision, including review and approval of all portions of any improvements prior to commencement by the Owner.

Section 2. "Assessments" means the amount which is paid by the Owner to the Association for Common Area and other expenses under the Governing Documents.

Section 3 "Association" means the corporate entity to be formed to serve as the owners association known as The Parklands at Camas Meadows Residential Homeowners' Association, its successors and assigns, or such other name as decided by the Declarant. In an absence of a corporate entity, the Association shall be composed of the owners of each lot in the Subdivision, who shall own all common area as tenants in common, subject to the requirements and provisions of this Declaration. The Association shall be governed by a Board of Directors, all more particularly set forth in the Governing Documents for the Association.

Section 4. "Board" means the Board of Directors of the Association. The members of the Board are not required to be an owner in the Subdivision or a member of the Association to serve on the Board, and may consist of the Declarant (in its discretion) until the occurrence of the event under Article IV(2) below.

Section 5. "Common Area" means those areas set forth in the Plat, which shall be the responsibility of the Association, including without limitation, easements, right of ways, private roads, trails, boardwalks, sidewalks, street lights, signs, fences, gates & entry areas, retaining walls, landscaping & drainage areas, irrigation equipment, pipes & equipment, step sewer system, storm water system, utilities, communication lines, or other equipment or amenities that serve the Common Area, which are owned by the Association for Parklands at Camas Meadows Residential Subdivision, for the common use by the Owners, as may be amended.

Section 6. "Declarant" means Estates at Parklands LLC, a Washington limited liability company, any successor or assign, including the Association, which expressly retains its rights and powers under this Declaration, in conjunction with the sale or transfer of all, or substantially all, the Lots within the Subdivision.

Section 7. "Declaration" means the Declaration of Protective Covenants, Conditions, Restrictions and Easements for the Parklands at Camas Meadows Subdivision, as may be amended.

Section 8. "Dwelling Unit" means a building or a portion of a building located upon a Lot and intended for separate occupancy and ownership.

Section 9. "Easement" means the areas on the Plat, which may be located within a Lot or within Common Area, to be used as a non-exclusive area for the benefit of the Association, as may be amended.

Section 10. "Governing Documents" mean the Articles of Incorporation and Bylaws of the Association, this Declaration, and any rules or regulations adopted by the Association, as many be amended.

Section 11. "Improvement" means any addition to any Lot within the Subdivision, including without limitation, structures, utilities, lighting, signs, parking, walkways, driveways, and landscaping.

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Section 12. "Lot" means the platted or partitioned lot or tract within the Subdivision, set forth on the Plat, with the exception of any lot or tract marked on the Plat as being Common Area, as may be amended.

Section 13. "Owner" means the record owner, whether one or more persons or entities, of a fee simple title to any Lot which is a part of the Subdivision, including contract sellers, but excluding those having such interest merely as security for the performance of an obligation.

Section 14. "Properties" or "Property" means that property in the Subdivision, which constitutes the residential portion of the Plat, as may be amended.

Section 15. "Subdivision" means Lots 1 -42 within the Plat, as may be amended.

ARTICLE II

PROPERTY RIGHTS

Section I. General. Except as hereinafter provided, every Owner shall have the right of peaceful and exclusive possession of its Lot. The Association, however, shall have the right to establish and enforce reasonable rules and regulations relating to the Common Area without any requirement for an amendment of this Declaration.

Section 2. Maintenance of Common Area. Subject to any shared rights and obligations held by the Archery at Camas Meadows Business Park, and subject to the following, the Association shall be responsible for the maintenance of the Common Area. In the event any portion of the Common Area is shared with a third party, including without limitation, shared access roads, the Association shall comply with any requirement of the Plat or governmental approvals related to the Plat regarding installation, maintenance or improvement of such shared areas.

a) Storm Water System. Subject to any shared rights and obligations held by the Archery at Camas Meadows Business Park, the Storm Water System, as set forth on the Plat, shall be owned and maintained by the Association ("Storm Water System"). Right of entry to the Storm Water System shall be granted to the City of Camas for Inspections. The Storm Water System, includes without limitation, storm water collection, detention, infiltration and treatment facilities (manholes, filters, collection lines, catch basins, and dry wells above or below ground). Roof drain infiltration systems for Lots shall be collected on individual Lots, then collected into the Storm Water System. And, the individual Lot owners are responsible for the roof drain collection areas until accumulation into the Storm Water System. The individual Lot Owners hereby grant an easement for access and maintenance on each Lot to the Association for anything related to the roof drain infiltration system. The Association shall be responsible for all necessary maintenance and operation of the Storm Water System pursuant to the conditions of approval of the Plat and all applicable regulations by the City of Camas, including inspections. Failure of the Association to comply herein

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will subject the Association to all applicable penalties by the City. The Storm Water System is subject to inspection by the City at least bi-annually.

The Storm Water System will also collect and treat water from Camas Meadows Drive, Larkspur Street, Archery Business Park, and Village Properties (south and southeast owned by Oliva/Olson our successors).

b) Easements. Each Lot owner hereby grants a non-exclusive easement to the Association for access and maintenance on any Lot for any item in which the Association has management or maintenance obligations, as set forth on the Plat. Easements in the Common Area shall be maintained by the Association in a neat and attractive condition, and pursuant to all applicable law. In the event the Association requires access to any Easement on a Lot, the Association shall be responsible for contacting the Owner of the Lot prior to access and commencement of any such maintenance. The Association shall use licensed and bonded contractors who shall promptly and reasonably repair any disturbance or alteration to such Lot, and in compliance with all applicable law.

Without limiting anything set forth within and subject to the "Tract and Easement Notes" set forth on the Plat:

c) Wetlands. The wetlands as depicted on Tract "A" and "B" on the Plat shall be owned and maintained by the Association ("Wetlands") pursuant to the Timber Management Plan, prepared by HFI Consultants, dated August 6, 2016. The Wetlands shall remain in their natural state unless otherwise approved by the City of Camas.

d) Fencing & Signage for Wetland Buffer. Permanent and continuous fencing and permanent signage shall be installed, owned and maintained by the Association along the outer edge of the wetland buffer on Tracts "A" and "B" abutting all Lots and tracts, as set forth on the Plat. The signs shall read "Wetland Area – Leave in its Natural State – It is Illegal to cut, prune, or mow in the Area, Call the City of Camas for Information".

e) Trails. The trail system is depicted on Tract "A", "B", "F" on the Plat which shall be owned and maintained by the Association ("Trails").

f) Open Space. The open space is depicted on Tract "D" on the Plat ("Open Space"). The Open Space shall be owned and maintained by the Association.

g) Private Roads & Utility Tracts. NW Pittock Place, NW McMaster Drive & NW Longbow Lane are depicted on Tract "F" and "H" on the Plat ("Private Roads & Utility Tracts"). The Private Roads & Utility Tracts are hereby granted to the Association with the Plat. The Private Roads & Utility Tracts shall be owned, maintained and used by the Association.

h) Shared Driveway Easements. Lot 2 hereby grants a non-exclusive easement for ingress, egress and utilities over the east 20 feet of Lot 2 for a shared driveway between Lot 2, Lot 3 and Lot 4 ("Shared Driveway"). The Lot Owners of the Shared Driveway shall share the cost of construction and all maintenance and repair of the Shared Driveway. In the event any such Lot Owner develops and improves their Lot

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and constructs the Shared Driveway prior to the other Lot Owner's purchase and development, the Lot Owner incurring such cost shall be reimbursed by the other Lot Owners within 30 days of close of escrow on the subsequent Lot. The ARC may, at its election, may assist with coordination between the Lot Owners.

Section 3. Reservation of Easement. Without limiting any Easement or Common Area defined herein or set forth on the Plat, Declarant also reserves all right, title and interest in the following, as may be amended:

a) Easement for six (6) foot strip along (in, on and under) front yard boundary lines of each Lot for construction, installation, usage and repair of electric, cable, telephone, water, drainage, & sewer.

b) Easement for six (6) foot strip along front yard boundary lines of each Lot for construction, installation, usage and repair of sidewalks (including ADA slope requirement).

c) Easement for ten (10) foot strip along front yard boundary lines of each Lot for construction, installation, usage and repair of landscaping, irrigation and fencing for area(s) which adjoin commercial development.

d) Common Area easements, right of ways, private roads, trails, boardwalks, sidewalks, street lights, signs, fences, gates & entry areas, retaining walls, landscaping & drainage areas, irrigation equipment, pipes & equipment, step sewer system, storm water system, utilities, communication lines, or other equipment or amenities that serve the Common Area.

e) Dedication or transfer of any part of any easement within the Common Area to any public agency or utility for such purposes and subject to such conditions as may be determined by those parties.

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ARTICLE III

ARCHITECTURAL CONTROL

Section 1. The Architectural Review Committee ("ARC") shall initially be composed of a person(s) designated by the Declarant, which may be the Declarant, its successors, assigns, agents or representatives. At such time as Class B membership terminates, the ARC shall be appointed by the Board of Directors of the Association and shall consistent of at least 3 members, and the Declarant may remain a member (in its discretion) thereafter until conveyance of all Lots owned by Declarant. In the absence of such appointment, the Board of the Association shall serve as the ARC. Two-thirds (2/3rds) of the ARC shall constitute a quorum thereof. The approval of the ARC for matters under its review will not be unreasonably withheld provided the proposed improvement meets the criteria in this Declaration and complements the general design and material criteria within the Subdivision. The ARC, in its sole discretion, may enact rules and regulations regarding an appeal of any ARC decision.

Section 2. The ARC and/or the Association shall not be responsible or liable, to any other Owner in the Association or any third party, for any unlawful or defective proposal submitted or improvement erected by any Owner, including without limitation, any plans or specifications proposed by any Owner (or their representative) or any building or structure erected according to such plans and specifications. This limitation of liability shall include, without limitation, all issues relating to timing for approvals or rejections. Consent by the ARC to any matter proposed herein shall not be deemed to constitute a precedent or waiver regarding its right to withheld consent to any other matter proposed thereafter.

Section 3. No improvement, structure, fencing, or landscaping shall be erected or permitted to remain on any Lot except a structure or landscaping which has been approved or waived by the ARC prior to commencement of any jurisdictional approval. The ARC review and approval shall include but not be limited to, color, design, height, materials for all improvements, including without limitation, buildings, fences, retaining walls, hardscape and landscape planting as set forth hereinbelow. The Owner shall submit any materials or information reasonably requested by the ARC, including without limitation, plans & specifications, sketches, material & color samples, reports or studies related to soils, compaction, engineering, surveying, and arborists. If the ARC fails to respond to a proposal submitted by the Owner within thirty (30) days after the complete submittal has been delivered to the ARC, the submittal (as delivered) shall be deemed approved provided it is completed within one (1) year of said approval. The ARC shall have 30 days to respond to all submittals, including additions and changes to the request for approval, by the Owner. The ARC shall have the discretion to make reasonable variations to the requirements of this Article III.

Section 4. The construction of the primary dwelling unit or other structure shall be completed, including exterior paint and finish materials and landscaping, within 12 months from commencement of such construction or improvement. Outbuildings, accessory dwelling units ("ADU") or other auxiliary structures shall be constructed with the same design and color scheme and complement Lot character of the dwelling. Any vacant Lot shall be mowed and kept in an attractive condition at all times. In the event that a Lot remains vacant after any transfer of ownership, for more than six (6) months without the commencement of construction of the primary dwelling unit, the ARC may, at its discretion, complete the landscaping and fencing at the expense of the Lot Owner.

Section 5. Each Lot shall be permitted to have one (1) primary dwelling unit and one (1) ADU. An ADU is permitted to be constructed before the primary dwelling unit as long as the primary dwelling unit is constructed within 12 months from occupancy permit of the ADU.

Section 6. The ground floor area of the primary dwelling unit, exclusive of garage or ADU, shall be at least 2,300 square feet. The ground floor area of a multiple level dwelling, exclusive of garage or ADU, shall be at least 2,000 square feet and at least 3,000 total square feet.

Section 7. No side or backyard fence or perimeter wall height shall be permitted in excess of six (6) feet. Fence and gate material shall be black or dark colors

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constructed of ornamental steel, iron, or aluminum, with designs and color approved by ARC. Wood fencing shall not be permitted. Fencing shall not be located past front corners of the primary dwelling unit. Any swimming pool fencing must be the same as the other fencing on the Lot. No fencing in the front yard of any Lot shall be permitted. Any Lot adjoining an exterior perimeter line of the Subdivision or Common Area shall be fenced, screened, or walled to maintain reasonable continuity of design and security for the remainder of the neighborhood. Gates may be allowed at driveway entrances for shared driveways upon ARC approval. Gates shall match the design and material of the balance of fencing on each Lot. Perimeter walls may be constructed subject to similar specifications using masonry material as may be pre-approved by the ARC. All fences and walls shall be subject to ARC final approval prior to construction. All Common Area fencing, as may be required by the City of Camas, will be constructed and maintained by the Association and at the cost of the Association, or as otherwise approved and permitted by the Association.

Section 8. All improvements within the Subdivision shall include the following, without limitation, and shall be subject to prior review and approval of the ARC:

a) Driveways/Non-Landscaped Areas. Exposed aggregate concrete, stamped or sculptured concrete, stained or sand finished concrete, concrete pavers, or other surfaces as may be approved by the ARC. Broom brushed concrete and asphalt shall not be used on any Lot without ARC approval.

b) Roofing. 50-year composition or equivalent material, tile, metal raised seam with color, as approved by the ARC.

c) Decks & Patios. Surface material and finishes for all decks and patios shall be synthetic, IPE, natural finished wood, exposed aggregate, or concrete pavers, as approved by the ARC.

d) Siding. Multiple styles and textures and materials are required, as approved by the ARC. Approved materials include IPE, brick, stone, stucco, and others as approved by ARC. No vinyl, metal, T1-11, or unfinished plywood materials are allowed.

e) Paint. The exterior of each structure, including without limitation, primary dwelling unit, ADU, outbuildings and other auxiliary structures, and all portions attached to such structures, shall be painted with an ARC approved color scheme common to the entire structure. Perimeter fencing on Lots along the exterior boundaries shall be painted or finished material with similar color(s) along each boundary, as approved by the ARC.

f) Landscaping. All Lots shall be 100% landscaped and shall include automated irrigation systems, as approved by the ARC. After the first transfer of any Lot and prior to the construction of any improvements, all Lots shall be kept in a neat and orderly condition and free of brush, vines, weeds, and the grass shall be cut and mowed at sufficient intervals to prevent the creation of a nuisance or fire hazard.

g) Alternate Energy. Solar, wind and other alternative power sources which can be viewed by public are subject to specific review and approval of location by the ARC.

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h) Impact Fees. Lots may be subject to impact fees by the City of Camas which shall be the responsibility of the Low Owner.

ARTICLE IV

ASSOCIATION MEMBERSHIP

Section I. Every Owner of a Lot shall be a member of the Association. Membership shall be appurtenant to and may not be separated from ownership of any Lot.

Section 2. The Association shall have two classes of voting membership:

a) Class A members shall be all Owners, with the exception of the Declarant, and shall be entitled to one (1) vote for each Lot owned. When more than one (1) person holds an interest in any Lot, all such persons shall be members. The vote for such Lot shall be exercised as they determine, but in no event shall more than one (1) vote be cast with respect to any Lot.

b) Class B member shall be the Declarant and shall be entitled to three (3) votes for each Lot owned by the Declarant. The Declarant shall vote the Lots for which it an Owner. The Class B membership shall cease and be converted to Class A membership on the happening of either of the following events, whichever occurs earlier:

(i) when the total votes outstanding in the Class A membership equal the total votes outstanding in the Class B membership, or

(ii) on January 1, 2022.

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ARTICLE V

ASSESSMENTS

Section I. Creation of the Lien and Personal Obligation of Assessments. Each Owner of any Lot by acceptance of a deed therefor, whether or not it shall be so expressed in such deed, is deemed to covenant and agree to pay to the Association: (l) annual assessments or charges for Common Area and Association expenses, and (2) special assessments for capital improvements, and any other necessary expenses for the Subdivision. Such assessments to be established and collected as hereinafter provided. The annual and special assessments, together with interest, costs and reasonable attorney's fees, shall be a charge on the Lot and shall be a continuing lien upon the Lot against which each such assessment is made. Each such assessment, together with interest, costs and reasonable attorney's fees, shall also be the personal obligation of the person who was the Owner of the Lot at the time when the assessment became due. The personal obligation for delinquent assessments shall

become a lien and pass to the successors in interest unless expressly released by the Association. Lots belonging to the Declarant shall be exempt from assessment as to any such Lot until after the first transfer of deed or construction of a dwelling by the Declarant is completed together with the issuance of an occupancy permit and there shall be no accrual of any assessment obligation prior to such deed transfer or construction.

Section 2. Purpose of Assessments. The assessments levied by the Association shall be used exclusively to fulfill the Association's rights and obligations with respect to the operation and maintenance of the Common Area, and for the maintenance of the Association and the conduct of its affairs.

Section 3. Initial and Maximum Annual Assessment. Until December 31, 2018, the initial and maximum annual assessment shall be One Thousand Five Hundred and 00/100 Dollars ($1,500.00) per Lot. Upon the initial sale or transfer of a Lot by the Declarant, the current annual dues shall be prorated and paid by the purchaser of the Lot plus the next full year at the current established rate. Any subsequent sale or transfer of the Lot shall be prorated between the seller of the Lot and the purchaser of the Lot and notice shall be given by the seller to the Association prior to the close of escrow.

a) From and after December 31, 2018, the maximum annual assessment may be increased for each year not more than twenty per cent (20%) accruing each year above the maximum assessment for the previous year by the Declarant or Board of Directors without a vote of the Owners.

b) From and after January I of the next year, the maximum annual assessment may be increased above twenty per cent (20%) by a vote of one-half of the Owners allocated votes who are voting in person or by proxy, at a meeting duly called for this purpose.

c) The Board of Directors may fix the annual assessment at an amount not in excess of the maximum.

d) The Board of Directors may, at its discretion, allow for annual assessments to be paid in full or allow assessments to be paid over 12 monthly installments, provided all Lots and Owners are treated equally.

Section 4. Special Assessments.

a) Capital Improvements. In addition to the annual assessments authorized above and as herein provided in Section 4(b), the Association may levy, in any assessment year, a special assessment applicable to that year only for the purpose of defraying, in whole or in part, the cost of any construction, reconstruction, repair or replacement of a capital improvement upon any Common Area, including fixtures and personal property related thereto, provided that any such assessment shall have the agreement of fifty percent (50%) of the votes of each class of members (Owners) who are voting in person or by proxy at a meeting duly called for this purpose.

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b) Initial Special Assessment. Upon the initial close of escrow and conveyance of a Lot by the Declarant, the first Owner of each Lot shall pay a fixed special assessment in the amount of One Thousand Five Hundred and 00/100 Dollars ($1,500.00) to the Association, collected and paid through escrow, to capitalize the initial Association maintenance and expenditure budget.

Section 5. Notice and Quorum. Written notice of any meeting called for the purpose of taking any action authorized under Article V, Section 3 or 4 shall be sent to Owners not less than fifteen (15) days nor more than sixty (60) days in advance of the meeting. At the first such meeting called, the presence of Owners or of proxies entitled to cast sixty per cent (60%) of all the authorized votes of Association shall constitute a quorum. If the required quorum is not present, another meeting may be called subject to the same notice requirement, and the required quorum at the subsequent meeting shall be one-half (l/2) of the required quorum at the preceding meeting. No such subsequent meeting shall be held more than sixty (60) days following the preceding meeting.

Section 6. Uniform Rate of Assessment. Both annual and special assessments, excluding Declarant held Lots, must be fixed at a uniform rate for all Lots and may be collected 30 days in advance of said assessment period.

Section 7. Date of Commencement of Annual Assessments. The annual assessments provided for herein shall commence as of the date of first transfer of deed to a Lot Owner. Prior to the first transfer of a Lot, the Lots owned by the Declarant shall not be assessed. The Board of Directors shall fix the amount of the annual assessment against each Lot at least thirty (30) days in advance of each annual assessment period. Written notice of the annual assessment shall be sent to every Owner. The due dates shall be established by the Board of Directors. The Association shall, upon demand, and for fee established by the Board of Directors, furnish a certificate signed by an officer of the Association setting forth whether the assessments on a specified Lot has been paid. A properly executed certificate of the Association as to the status of assessments on a Lot is binding upon the Association as of the date of its issuance. The assessment year shall be from January 1. The annual assessment shall be prorated for the balance of the assessment year.

Section 8. Annual Assessments and Maintenance Fund. The Board of Directors shall establish and maintain an reserve account with a banking institution and deposit sufficient funds annually for the projected replacement obligations of the Association.

Section 9. Effect of Nonpayment of Assessments. Any assessment not paid within thirty (30) days after the due date shall bear interest from the due date at the rate of twelve per cent (12%) per annum and incur a late fee of Fifty and 00/100 Dollars ($50.00) monthly if the Association gives prior written notice to the Owner by regular postal service at the Owner's last known address, or the address shown in the records of the Clark County Assessor for tax purposes. The Association may bring an action against the Owner personally obligated to pay the same, or foreclose the lien against the Lot. No Owner may waive or otherwise escape liability for the assessments provided for herein by non-use of any Common Area or abandonment of the Lot. The Board of

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Directors shall have the authority to adjust the rate and penalty for non-payment of assessments by a 2/3rds vote of the Board.

Section I0. Subordination of the Lien to Mortgages. The lien of the assessments provided for herein shall be subordinate to the lien of any first mortgage. Sale or transfer of any Lot shall not affect the assessment lien.

Section 11. Default. In the event of any Owner default under this Declaration, and after 30 day notice by the Association and the Owner's failure to cure the default, the Association shall have any and all remedies available at law or in equity. Further, in the event the Owner fails to maintain the exterior of a Lot, the Association may elect to make any necessary repairs or maintenance, at the Owners expense. In the event of any legal action, the Owner shall be responsible for attorney's fees and costs.

ARTICLE VI

AUTHORITY AND DUTY OF THE ASSOCIATION

Section 1. The Association, acting through its Board of Directors, as elected pursuant to the Governing Documents of the Association, shall have the authority and the duty to manage the Association, enforce the Declaration, including without limitation:

a) Cause to be kept a complete record of all its acts and corporate affairs and to present a statement thereof to the Owners at the annual meeting, or at any special meeting when such statement is requested in writing by one-fourth (1/4th) of the Owners.

b) Supervise all officers, agents, contractors, and employees of this Association.

c) Fix the amount of the annual assessment against each Lot at least thirty (30) days in advance of each annual assessment period; and send written notice of each assessment to every Owner at least thirty (30) days in advance of each annual assessment period; collect such assessments, and record a lien against any Lot for which assessments are not paid within thirty (30) days after due date or to bring an action against the owner personally obligated to pay the same.

d) Procure and maintain adequate liability and hazard insurance on Common Area owned by the Association

e) Procure and maintain adequate directors and officers liability insurance.

f) Cause all officers or employees having fiscal responsibilities to be bonded, as it may deem appropriate.

g) Manage and maintain all Common Areas in good condition and repair, as originally installed and approved by governing authorities. No individual officer shall have any liability to any Owner or other person, other than the Association.

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h) Require the signature of all checks, drafts, or account withdrawals that exceed $2,500.00 by two (2) Board members.

i) As authorized in the Declaration, establish rules and regulations.

j) Select and hire professional property management to facilitate the duties of the Association and its Board.

k) Establish budgets, including adequate reserves for the Common Area, as required by applicable law.

Section 2. The Board of Directors shall not elect members of the Board outside of duly authorized elections, as authorized by the Governing Documents of the Association. Provided, however, duly elected members of the Board are not required to be an Owner in the Subdivision or a member of the Association to serve on the Board.

ARTICLE VII

USE RESTRICTIONS

All Lots, usage of the Lots and/or all Improvements on any Lot, shall be subject to the following which may be enforced by the Declarant, the Board and/or subject to prior ARC review and approval:

Section 1. No Subdivision or Partition. No Lot shall be further subdivided or partitioned to create more than one legal lot

Section 2. Residential Use. Lots shall be used for residential purposes only. Except with the consent of the Association, no trade, craft, business, profession, commercial or similar activity of any kind shall be conducted on any Lot, nor shall any goods, equipment, vehicles, materials or supplies used in connection with any trade, service, or business be kept or stored on any Lot. Nothing in this paragraph shall be deemed to prohibit (a) activities relating to the rental or sale of the Lot, (b) the right of Declarant or any contractor or homebuilder to construct improvements on any Lot, to store construction materials and equipment on such Lots in the normal course of construction, and to use any Lot as a sales or rental office or model, and/or (c) the right of the Owner of the Lot to use the residence as a home office, including without limitation, to maintain his professional personal business or professional telephone calls or confer with business or professional associates, clients or customers. Provided, however, the residence shall not be open to the public and is limited to occasional by-appointment-only customer, client or trade visitor visitation. The Association shall not approve commercial activities otherwise prohibited by this Section unless the Association determines that only normal residential activities would be observable outside of the residence.

Section 3. Offensive or Unlawful Activities. No unlawful, noxious or offensive activities shall be carried on upon any Lot, nor shall anything be done or placed on any

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Lot which interferes with or jeopardizes the enjoyment of other Lots, or which is a source of annoyance to other Owners.

Section 4. Fire & Fireworks. There shall be no open fire or open flame allowed anywhere within the Subdivision for any purpose except within a professionally crafted personal-use recreational fire pit. There shall be no use or ignition of firecrackers or fireworks of any kind, legal or illegal, anywhere within the Subdivision.

Section 5. Erosion. No Owner or resident of a Lot shall allow any condition to exist that causes soil erosion. If a condition of soil erosion occurs on a Lot, it shall be the responsibility of the Owner of the Lot to correct the condition and stop the erosion. No Owner shall denude or strip a Lot causing erosion to occur, except during construction wherein the conditions are controlled and temporary. All bare dirt shall be covered with straw or a similar substance that is designed to prevent rainwater from eroding bare soil. Hay bales, silt fences, catch-basin bags and other measures required by the City of Camas' erosion control ordinance, and the drainage and erosion control plans approved for by the land use approval governing the Lot shall be employed for all construction activities.

Section 6. Commercial Vehicles. No vehicle used in the conduct of a trade or business, which is identified as used in connection with a trade or business, shall be parked on any Lot or within the Subdivision, except entirely within a fully enclosed building on the Lot.

Section 7. Large Vehicles Prohibited. No vehicles with a gross weight exceeding 20,000 pounds shall be stored or parked anywhere on a Lot or within the Subdivision, except for vehicles used during construction on the Lot.

Section 8. Animals. No animals, livestock or poultry of any kind shall be raised, bred or kept or permitted within any Lot or the Subdivision other than a reasonable number household pets as established by the Association. No household pets shall be bred or raised on any Lot for sale or commercial purposes. Any nuisance or damage caused by an animal shall be the responsibility of Owner thereof. No dog shall be permitted to roam an unenclosed area of a Lot or within the Subdivision unattended, and all dogs shall be kept on a leash while outside a Lot. An Owner or resident may be required to remove an animal upon receipt by the Association of the third written notice of any violation of any rule, regulation or restriction governing animals within the Subdivision. Animal enclosures, including dog runs and houses, shall not be located in any yard areas of Lots, which are visible to the public.

Section 9. Maintenance of Structures and Lots. Owners shall maintain all Lots and improvements in a clean and attractive condition, in good repair and shall not to create a fire hazard. Such maintenance shall include, without limitation, painting, repair, replacement and care for roofs, gutters, downspouts, exterior building surfaces, walks and other exterior improvements and glass surfaces. All repainting or re- staining and exterior remodeling shall be subject to prior review and approval of

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the ARC of the Association. In addition, each Owner shall keep all shrubs, trees, grass and plantings of every kind on the Lot, neatly trimmed, properly cultivated and free of trash, weeds and other unsightly material, except that the Association will be responsible for maintenance of Common Area. The Association shall have the right to provide for the maintenance and repair on any Lot in violation hereof, and the Owner shall be responsible for such costs.

Section 10. Parking.

a) No Owner or resident shall park any vehicle which blocks or impedes the neighboring Lot's access to on any shared driveway.

b) Vehicles which are not in regular use or are inoperable shall not be parked in streets or driveways on any Lot or within the Subdivision.

c) No parking or storage of boats, trailers, motorcycles, trucks with the identification of any trade or business, mobile homes, campers or other recreational vehicle or equipment, regardless of weight, and no vehicles in excess of 20,000 pounds, shall not be allowed to park within the Subdivision, or allowed or park on any Lot, for more than forty-eight (48) hours or such other period as may be permitted by the Association, except within a completely enclosed garage.

Section 11. Vehicle Maintenance and Vehicles in Disrepair.

a) Vehicle maintenance or repair shall not be conducted on streets or driveways within the Subdivision. All vehicle maintenance and repair completed on the Owner's Lot shall be within an enclosed garage.

b) No Owner or resident shall permit any vehicle which is not drivable, or which is in an extreme state of disrepair, to be abandoned or to remain parked upon any Lot or on any street or driveway for a period in excess of forty-eight (48) hours, unless the vehicle is kept entirely within a fully-enclosed garage. A vehicle shall be deemed in an extreme state of disrepair upon determination by the Association. In the event any Owner fails to remove such vehicle within five (5) days following the date on which notice is mailed by the Association, the vehicle may be removed by the Association at the expense of the Owner.

Section 12. Signs. No signs shall be erected or maintained on any Lot except that not more than one For Sale sign placed by the Owner, Declarant or by a licensed real estate agent, not exceeding five (5) square feet in size may be temporarily displayed on the Lot. No For Rent signs shall be permitted on any Lot. The restrictions contained in this Section shall not prohibit signs in windows or warning notices if approved by the Association or the temporary placement of political signs on any Lot by the Owner. No signs may be mounted on or nailed to trees, and all signs must conform to applicable municipal codes and ordinances.

Section 13. Rubbish and Trash. No Lot or Common Area within the Subdivision shall be used as a dumping ground for trash or rubbish of any kind. All garbage and other waste shall be kept in appropriate sanitary containers for proper

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disposal, and except for day of collection shall be kept within garages or a screened enclosure which is out of public view. Yard rakings, dirt and other material resulting from landscaping work shall not be dumped onto streets, sidewalks, driveways, Common Area, or on any Lot. In the event any Owner fails to remove any trash, rubbish, garbage, yard rakings or any such materials from any Lot or Common Area within ten (10) days following the date on which notice is mailed by the Association, the Association may have such materials removed and charge the expense of such removal to the Owner.

Section 14. Common Area. The Association shall properly maintain all Common Areas as needed or required, except where the easement for landscaping serves a Lot, in which case, the landscaping shall be maintained by the Owner; provided, however, that the Association may elect to maintain some or all such landscaping and may collect assessments for that purpose from Lot Owners. No owner or resident shall alter, damage, replace, or change any landscaping within the Common Area without consent from the Association. Fencing surrounding the Common Area shall be installed and maintained by the Association as described in Article III herein.

Section 15. Temporary Structures. No structure of a temporary character, trailer, motor home, tent, shack or other non-conforming structure shall be permitted on any Lot, at any time, as a residence or for any other type of occupancy, either permanently or temporarily.

Section 16. Mechanical Equipment. No mechanical equipment, including, without limitation, window mounted air conditioners, dishes, or solar panels, shall be allowed in the front elevation of any Lot and shall not be visible by public view.

Section 17. Outdoor Facilities. The following are subject to prior ARC review and approval:

a) All utility connections from trunk lines to dwellings shall be underground. Exposed plumbing or electrical lines are not permitted within any Lot.

b) Basketball facilities on a Lot shall not be in use between the hours of 8am and 9pm, and may be required to be screened from public view

c) Tennis courts, swimming pools, hot tubs, are all allowed if screened from the public view. All lighting for such activities shall be restricted between the hours of 8pm and 9am.

d) Any mailbox other than as originally supplied at the time of construction, or the Post Office, shall require the prior approval of the ARC.

e) Service facilities (garbage, clotheslines, etc.) shall be screened from public view and adjacent Lots.

Section 18. Antennas and Satellite Disks. Exterior radio, television, telecommunication towers, antennae, satellite dishes larger than 24" in diameter or

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other exterior transmission or receiving devices shall not be permitted on any Lot. Location of all antennas or satellite equipment within street view shall require approval of the ARC.

Section 19. Exterior Lighting or Noise-Making Devices. No exterior lighting or noise-making devices shall be installed or maintained on any Lot, other than security and fire alarms, and shall adhere to Camas City Code and Development Agreement requirements for Parklands at Camas Meadows.

Section 20. Pest Control. No Owner shall permit any condition to exist upon any portion of a Lot which shall induce, breed or harbor infectious plant disease or noxious insects or vermin.

Section 21. Association Rules and Regulations. The Declarant or Board of Directors may adopt Rules and Regulations by separate unrecorded document governing the conduct and use of any all Lots in the Subdivision provided such rules and regulations do not conflict with the Declaration or Bylaws of the Association.

Section 22. Area Around Hydrants. A 6-foot clear space shall be maintained around all fire hydrants.

Section 23. Archaeological. If any cultural resources are discovered during any development on the Lot, the Office of Archaeology and Historic Preservation (360-586-3065), the City of Camas Planning Department, and the affected Tribes shall be notified immediately. Failure to comply with these State requirements may constitute a Class C Felony, subject to imprisonment and/or fines.

Section 24. Critical Aquifer Recharge Areas. The dumping of chemicals into the groundwater and the use of excessive fertilizers and pesticides shall be avoided. Owners are encouraged to contact the State Wellhead Protection program at (206) 586-9041 or the Washington State Department of Ecology at 800-RECYCLE for more information on groundwater/drinking supply protection.

Section 25. Easements. Subject to the provisions of this Declaration, Easements for the installation of utilities and drainage facilities and any area included in aid of easements shall be maintained in as attractive and well-kept condition as the remainder of the Lot.

Section 26. Mobile Homes. Mobile homes, pre-manufactured homes or any temporary and non-conforming structures are prohibited in the Subdivision.

ARTICLE VIII

GENERAL PROVISIONS

Section I. Enforcement. The Association, or any Owner, shall have the right to enforce this Declaration by any proceeding at law or in equity, all restrictions, In the

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event the Association deems any default for a Lot Owner to create a nuisance or the likelihood to cause damages to person or property, the Association, may in its sole discretion, take such action to enforce the terms and conditions of this Declaration on any Lot, and the Lot Owner shall be responsible for any and all costs related thereto. Failure by the Association or by any Owner to enforce any covenant or restriction herein contained shall in no event be deemed a waiver of the right to do so thereafter.

Section 2. Severability. Invalidation or modification of any portion of this Declaration, by judgment or court order, shall in no way affect any other provision, which shall remain in full force and effect.

Section 3. Conflict. In the case of any conflict between the Articles of Incorporation and the Bylaws of the Association, the Articles shall control. In the case of any conflict between the Declaration and the Bylaws, the Declaration shall control. Any rules or regulations created by the Association shall not conflict with any of the foregoing.

Section 4. Amendment. The covenants and conditions of this Declaration shall run with the land, binding on all successors, heirs and assigns for a term of twenty (20) years from the date this Declaration is recorded, after which time they shall be automatically extended for successive periods of ten (l0) years. This Declaration may be amended during the first twenty (20) year period by an instrument signed by not less than eighty per cent (80%) of the Lot Owners, and thereafter by an instrument after approval of not less than seventy-five per cent (75%) of the Lot Owners. Notwithstanding the foregoing, this Declaration shall not be amended, and any purported amendment shall not be effective as an amendment, within five (5) years of the recording of this Declaration except with the prior written approval of the Declarant. Any amendment to become effective must be recorded.

Section 5. City of Camas Approval. This Declaration is subject to the approval from the City of Camas, and subject to a Development Agreement with the City. Nothing in this Declaration shall be amended or construed to conflict with the approval granted by the City of Camas or the terms of the Development Agreement. Although the foregoing Declaration permits the Association to transfer the Common Area to a public entity and allows the Association to delegate and amend its obligations to maintain Common Area, no such action shall become effective which would conflict with the Subdivision approval or the terms of the Development Agreement, without prior written approval by the City of Camas. Further, this Declaration shall not be modified relating to the Storm Water System, without prior written approval of the City of Camas.

Section 6. Right of Declarant. Any and all rights, powers, duties, and reservations of Declarant herein contained may be assigned to any person, partnership, corporation or association. Notwithstanding anything herein which may be to the contrary, Declarant shall have the right for five (5) years from the date of recording to modify this Declaration without approval of the Association. However, the

Declarant may not change or amend this Declaration in a manner which conflicts with the Subdivision approval without the prior written approval of the City of Camas.

Section 7. Limitation of Liability. Neither the Declarant, nor any agent or employee of Declarant, shall be liable to the Association or any Owner relating to its obligations under the Declaration. Further, the Association, its officers, directors, representatives, agents and employees shall not be liable for acts and omissions done in good faith in the interpretation, administration and enforcement of this Declaration.

Section 8. Indemnification. The Association shall indemnify and defend the Declarant and each officer, director, representative, agent and employee of the Association from and against any and all liabilities, costs, demands, proceedings, damages, claims, judgments, deficiencies, attorney fees and costs resulting from their activities on behalf of the Association and/or under this Declaration, done in good faith, and within what they reasonably believed to be the scope of their power and authority, including, without limitation, such liabilities resulting from any error of judgment, acts or omissions unless caused by willful or reckless misconduct, including third party injuries and any damage or loss related to the Common Area or adjacent golf course.

Section 9. Attorney Fees. In the event of any suit relating to the Declaration or Subdivision, the prevailing party shall be entitled to reasonable attorney fees and costs.

"DECLARANT"

Estates at Parklands, LLC

Dated: By: _____

Its: Manager Estates at Parklands LLC

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STATE OF WASHINGTON)
)ss.
County of Clark)

I certify that I know or have satisfactory evidence thatis the person who appeared before me, and said person acknowledged that he signed this instrument on oath, and stated that he was authorized to execute the instrument and acknowledged it as a member of Estates at Parklands LLC, a Washington Limited Liability Company, to the free and voluntary act of such party for the uses and purposes mentioned in this instrument.

Dated this 22nd day of December, 2017.



Printed Name Valeria m telesco
Notary Public for Washington
My appointment expires 8/1/21

Unofficial Copy

EXHIBIT "A"

(Legal Description)

Lots 1 through 42, ESTATES AT THE ARCHERY in Vol. 311 of Plats, page 924, Clark County, Washington

Unofficial Copy

Unofficial Copy

ALTA COMMITMENT FOR TITLE INSURANCE

Issued By agent:

Fidelity National Title

COMPANY OF WASHINGTON, INC.

Commitment Number:

612876055

NOTICE

IMPORTANT - READ CAREFULLY: THIS COMMITMENT IS AN OFFER TO ISSUE ONE OR MORE TITLE INSURANCE POLICIES. ALL CLAIMS OR REMEDIES SOUGHT AGAINST THE COMPANY INVOLVING THE CONTENT OF THIS COMMITMENT OR THE POLICY MUST BE BASED SOLELY IN CONTRACT.

THIS COMMITMENT IS NOT AN ABSTRACT OF TITLE, REPORT OF THE CONDITION OF TITLE, LEGAL OPINION, OPINION OF TITLE, OR OTHER REPRESENTATION OF THE STATUS OF TITLE. THE PROCEDURES USED BY THE COMPANY TO DETERMINE INSURABILITY OF THE TITLE, INCLUDING ANY SEARCH AND EXAMINATION, ARE PROPRIETARY TO THE COMPANY, WERE PERFORMED SOLELY FOR THE BENEFIT OF THE COMPANY, AND CREATE NO EXTRACONTRACTUAL LIABILITY TO ANY PERSON, INCLUDING A PROPOSED INSURED.

THE COMPANY'S OBLIGATION UNDER THIS COMMITMENT IS TO ISSUE A POLICY TO A PROPOSED INSURED IDENTIFIED IN SCHEDULE A IN ACCORDANCE WITH THE TERMS AND PROVISIONS OF THIS COMMITMENT. THE COMPANY HAS NO LIABILITY OR OBLIGATION INVOLVING THE CONTENT OF THIS COMMITMENT TO ANY OTHER PERSON.

COMMITMENT TO ISSUE POLICY

Subject to the Notice; Schedule B, Part I-Requirements; Schedule B, Part II-Exceptions; and the Commitment Conditions, Fidelity National Title Insurance Company, a Florida corporation (the "Company"), commits to issue the Policy according to the terms and provisions of this Commitment. This Commitment is effective as of the Commitment Date shown in Schedule A for each Policy described in Schedule A, only when the Company has entered in Schedule A both the specified dollar amount as the Proposed Policy Amount and the name of the Proposed Insured.

If all of the Schedule B, Part I-Requirements have not been met within one hundred eighty (180) days after the Commitment Date, this Commitment terminates and the Company's liability and obligation end.

Fidelity National Title Insurance Company

By:

Randy Quirk, President

Countersigned By:

Authorized Officer or Agent
Matthew London

Attest:

Marjorie Nemzura, Secretary

This page is only a part of a 2016 ALTA® Commitment for Title Insurance issued by Fidelity National Title Insurance Company. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I-Requirements; Schedule B, Part II-Exceptions; and a counter-signature by the Company or its issuing agent that may be in electronic form.

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AMERICAN LAND TITLE ASSOCIATION

FIDELITY NATIONAL TITLE COMPANY OF WASHINGTON, INC.

COMMITMENT NO. 612876055

Transaction Identification Data for reference only:

ISSUING OFFICE:	FOR SETTLEMENT INQUIRIES, CONTACT:
Title Officer: Luke Bennier Fidelity National Title Company of Washington, Inc. 500 E Broadway St Suite 425 Vancouver, WA 98660-3335 Phone: 360-624-1046 Fax: 877-675-5393 Main Phone: (360)750-3686 Email: Luke.Bennier@fnf.com	Escrow Officer: Melissa Miller Fidelity National Title Company of Washington, Inc. 655 W. Columbia Way, Suite 200 Vancouver, WA 98660 Phone: 360-258-2222 Fax: 877-675-5387 Main Phone: (360)750-3686 Email: Melissa.Miller@fnf.com

Order Number: 612876055

SCHEDULE A

1. Commitment Date: May 13, 2021 at 08:00 AM
2. Policy to be issued:

   (a) ALTA Owner's Policy 2006

Proposed Insured:	Jon Ellsworth		
Proposed Policy Amount:	$1,900,000.00		
Premium:		$	1,648.00
Tax:		$	140.08
Rate:	Owner Subdivider Standard Coverage		
Total:		$	1,788.08

   (b) ALTA Loan Policy 2006

Proposed Insured:	Lender with contractual obligations under a loan agreement with the vested owner identified at Item 4 below or a purchaser		
Proposed Policy Amount:	$10,000.00		
Premium:		$	351.00
Tax:		$	29.84
Rate:	Lender Simultaneous Extended Coverage		
Total:		$	380.84

3. The estate or interest in the Land described or referred to in this Commitment is:

   Fee Simple

4. The Title is, at the Commitment Date, vested in:

   VestCapital Fund II, LLC, a Washington limited liability company

5. The Land is described as follows:

   SEE EXHIBIT "A" ATTACHED HERETO AND MADE A PART HEREOF

END OF SCHEDULE A

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EXHIBIT "A"

Legal Description

For APN/Parcel ID(s): 986043913 and 986043914

Lot(s) 43 and 44, ESTATES AT THE ARCHERY, according to the plat thereof, recorded in Volume 311 of Plats, Page 924, records of Clark County, Washington.

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SCHEDULE B, PART I
REQUIREMENTS

All of the following Requirements must be met:

1. The Proposed Insured must notify the Company in writing of the name of any party not referred to in this Commitment who will obtain an interest in the Land or who will make a loan on the Land. The Company may then make additional Requirements or Exceptions.

2. Pay the agreed amount for the estate or interest to be insured.

3. Pay the premiums, fees, and charges for the Policy to the Company.

4. Documents satisfactory to the Company that convey the Title or create the Mortgage to be insured, or both, must be properly authorized, executed, delivered, and recorded in the Public Records.

5. Additional requirements and/or exceptions may be added as details of the transaction are disclosed to, or become known by the Company.

6. The application for title insurance was placed by reference to only a street address or tax identification number. The proposed Insured must confirm that the legal description in this report covers the parcel(s) of Land requested to be insured. If the legal description is incorrect, the proposed Insured must notify the Company and/or the settlement company in order to prevent errors and to be certain that the legal description for the intended parcel(s) of Land will appear on any documents to be recorded in connection with this transaction and on the policy of title insurance.

7. The Proposed Policy Amount(s) must be increased to the full value of the estate or interest being insured, and any additional premium must be paid at that time. An Owner's policy should reflect the purchase price or full value of the Land. A Loan Policy should reflect the loan amount or value of the property as collateral. Proposed Policy Amount(s) will be revised and premiums charged consistent therewith when the final amounts are approved.

8. For each policy to be issued as identified in Schedule A, Item 2; the Company shall not be liable under this commitment until it receives a designation for a Proposed Insured, acceptable to the Company. As provided in Commitment Condition 4, the Company may amend this commitment to add, among other things, additional exceptions or requirements after the designation of the Proposed Insured.

9. If the Seller or Borrower intends to sign documents required to insure the transaction utilizing a remote online notary, please notify the Company immediately as additional underwriting requirements will need to be satisfied.

10. Possible matters relating to General Exceptions A, B, C and D herein in connection with any extended coverage policy shown in Schedule A to be issued. Adverse matters, if any, will be shown in a supplemental report to this commitment and will be shown as special exceptions in any policy to be issued unless cleared to the satisfaction of the Company.

11. A completed owner's affidavit (form to be supplied by the Company) will be required in connection with issuance of the policy(ies) shown in Schedule A.

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SCHEDULE B, PART I
REQUIREMENTS
(continued)

12. The Company will require the following documents for review prior to the issuance of any title insurance predicated upon a conveyance or encumbrance from the entity named below.

    Limited Liability Company: VestCapital Fund II, LLC

    a. A copy of its operating agreement, if any, and any and all amendments, supplements and/or modifications thereto, certified by the appropriate manager or member.

    b. If a domestic Limited Liability Company, a copy of its Articles of Organization and all amendment thereto with the appropriate filing stamps.

    c. If the Limited Liability Company is member-managed a full and complete current list of members certified by the appropriate manager or member.

    d. A current dated certificate of good standing from the proper governmental authority of the state in which the entity was created

    e. If less than all members, or managers, as appropriate, will be executing the closing documents, furnish evidence of the authority of those signing.

    The Company reserves the right to add additional items or make further requirements after review of the requested documentation.

END OF REQUIREMENTS

NOTES

The following matters will not be listed as Special Exceptions in Schedule B of the policy. There will be no coverage for loss arising by reason of the matters listed below because these matters are either excepted or excluded from coverage or are not matters covered under the insuring provisions of the policy.

Note A: Notice: Please be aware that due to the conflict between federal and state laws concerning the cultivation, distribution, manufacture or sale of marijuana, the Company is not able to close or insure any transaction involving Land that is associated with these activities.

Note B: Note: The Company finds no matters against the name(s) of Jon Ellsworth in the Public Records which would appear as exceptions in the policy.

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SCHEDULE B, PART I
REQUIREMENTS
(continued)

Note C: Note: The Public Records indicate that the address of the improvement located on said Land is as follows:

3815 NW Camas Meadows Drive
Camas, WA 98607
Affects: Lot 43

3711 NW Camas Meadows Drive
Camas, WA 98607
Affects: Lot 44

Note D: Note: There are NO conveyances affecting said Land recorded within 24 months of the date of this report.

Note E: Note: FOR INFORMATIONAL PURPOSES ONLY:

The following may be used as an abbreviated legal description on the documents to be recorded, per Amended RCW 65.04.045. Said abbreviated legal description is not a substitute for a complete legal description within the body of the document:

Lot(s) 43 and 44, ESTATES AT THE ARCHERY, 311/924
Tax Account No.: 986043913 and 986043914

Note F: Note: This map/plat is being furnished as an aid in locating the herein described Land in relation to adjoining streets, natural boundaries and other land. Except to the extent a policy of title insurance is expressly modified by endorsement, if any, the Company does not insure dimensions, distances or acreage shown thereon.

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SCHEDULE B, PART I
REQUIREMENTS
(continued)

Note G: Recording Charge (Per Document) is the following:

County	First Page	Each Additional Page
Clark and Cowlitz	Deed $103.50	$1.00 each additional page
Clark and Cowlitz	Deed of Trust Basic Fee $104.50	$1.00 each additional page

Note: When possible the company will record electronically. An additional charge of $4.00 plus sales tax applies to each document recorded electronically.

Note: A multiple transaction document bears an additional fee for each additional title.

Note: A document that fails to conform to certain formatting and page one requirements bears an additional $50.00 charge.

RECORDING AND PROCESSING CHARGES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Send all Recording Packages to:

Recording Department
655 W. Columbia Way, Ste 200
Vancouver, WA 98660

Email all Releases to:
ClarkWArecordings@fnf.com

END OF NOTES

END OF SCHEDULE B, PART I

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SCHEDULE B, PART II
EXCEPTIONS

THIS COMMITMENT DOES NOT REPUBLISH ANY COVENANT, CONDITION, RESTRICTION, OR LIMITATION CONTAINED IN ANY DOCUMENT REFERRED TO IN THIS COMMITMENT TO THE EXTENT THAT THE SPECIFIC COVENANT, CONDITION, RESTRICTION, OR LIMITATION VIOLATES STATE OR FEDERAL LAW BASED ON RACE, COLOR, RELIGION, SEX, SEXUAL ORIENTATION, GENDER IDENTITY, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN.

The Policy will not insure against loss or damage resulting from the terms and provisions of any lease or easement identified in Schedule A, and will include the following Exceptions unless cleared to the satisfaction of the Company:

GENERAL EXCEPTIONS

A. Rights or claims of parties in possession, or claiming possession, not shown by the Public Records.

B. Any encroachment, encumbrance, violation, variation, or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land.

C. Easements, prescriptive rights, rights-of-way, liens or encumbrances, or claims thereof, not shown by the Public Records.

D. Any lien, or right to a lien, for contributions to employee benefit funds, or for state workers' compensation, or for services, labor, or material heretofore or hereafter furnished, all as imposed by law, and not shown by the Public Records.

E. Taxes or special assessments which are not yet payable or which are not shown as existing liens by the Public Records.

F. Any lien for service, installation, connection, maintenance, tap, capacity, or construction or similar charges for sewer, water, electricity, natural gas or other utilities, or for garbage collection and disposal not shown by the Public Records.

G. Unpatented mining claims, and all rights relating thereto.

H. Reservations and exceptions in United States Patents or in Acts authorizing the issuance thereof.

I. Indian tribal codes or regulations, Indian treaty or aboriginal rights, including easements or equitable servitudes.

J. Water rights, claims or title to water.

K. Any defect, lien, encumbrance, adverse claim, or other matter that appears for the first time in the Public Records or is created, attaches, or is disclosed between the Commitment Date and the date on which all of the Schedule B, Part I—Requirements are met.

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SCHEDULE B, PART II
EXCEPTIONS
(continued)

SPECIAL EXCEPTIONS

1. Payment of the real estate excise tax, if required.

The Land is situated within the boundaries of local taxing authority of Clark County.

CAUTION: Washington has a graduated excise tax rate for sales occurring on or after 1/1/2020 for most properties, although a flat rate applies to properties formally classified and specially valued as timberland or agricultural land on the day of closing.

The rate of real estate excise tax to a sale on or after 1/1/2020 for properties which are not formally classified and specially valued as timberland or agricultural land is:

State portion: 1.10% on any portion of the sales price of $500,000 or less;
1.28% on any portion of the sales price above $500,000, up to $1,500,000;
2.75% on any portion of the sales price above $1,500,000, up to $3,000,000;
3.00% on any portion of the sales price above $3,000,000;

Local portion: .50% on the entire sales price.

An additional $5.00 State Technology Fee must be included in all excise tax payments.

If the transaction is exempt, an additional $5.00 Affidavit Processing Fee is required.

Any conveyance document must be accompanied by the official Washington State Excise Tax Affidavit, which can be found online HERE. The applicable excise tax must be paid and the affidavit approved at the time of the recording of the conveyance documents. (NOTE: Real Estate Excise Tax Affidavits must be printed as legal size forms).

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SCHEDULE B, PART II
EXCEPTIONS
(continued)

2. General and special taxes and charges, payable February 15, delinquent if first half unpaid on May 1, second half delinquent if unpaid on November 1 of the tax year:

Year:	2021
Tax Account No.:	986043913
School District/Levy Code:	117000
Assessed Total:	$156,585.00
Millage Rate:	12.0239057567
Location Code:	0602

General and Special Taxes:

First Half Billed:	$943.92
Second Half Billed:	$943.80
Unpaid:	$1,887.72
Affects:	Lot 43

Prior to close of escrow, please contact the Tax Collector's Office to confirm all amounts owing, including current fiscal year taxes, supplemental taxes, escaped assessments and any delinquencies.

3. General and special taxes and charges, payable February 15, delinquent if first half unpaid on May 1, second half delinquent if unpaid on November 1 of the tax year:

Year:	2021
Tax Account No.:	986043914
School District/Levy Code:	117000
Assessed Total:	$683,375.00
Millage Rate:	12.0239057567
Location Code:	0602

General and Special Taxes:

First Half Billed:	$4,110.97
Second Half Billed:	$4,110.84
Unpaid:	$8,221.81
Affects:	Lot 44

Prior to close of escrow, please contact the Tax Collector's Office to confirm all amounts owing, including current fiscal year taxes, supplemental taxes, escaped assessments and any delinquencies.

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SCHEDULE B, PART II
EXCEPTIONS
(continued)

4. Any unpaid assessments or charges and liability to further assessments or charges, for which a lien may have arisen (or may arise), as provided for under Washington law and in instrument set forth below:

   Imposed by: Archery at Camas Meadows Owner's Association
   Recording Date: December 5, 2017
   Recording No.: 5468232

5. Assessments, if any, levied by the City of Camas.

6. A deed of trust to secure an indebtedness in the amount shown below,

   Amount: $1,011,578.76
   Dated: September 23, 2020
   Trustor/Grantor: Vest Capital Fund II, LLC, a Washington limited liability company
   Trustee: Heurlin, Potter, Jahn, Leatham, Holtmann & Stoker, P.S.
   Beneficiary: WEH Lending, LLC
   Recording Date: September 24, 2020
   Recording No.: 5793108
   Affects: Said premises and other property

7. Development Agreement;

   Recording Date: March 28, 2016
   Recording No.: 5268706

8. Easement(s) for the purpose(s) shown below and rights incidental thereto as set forth in a document:

   In favor of: Pacific Power & Light Company
   Purpose: electric transmission and distribution line of one or more wires and all necessary or desirable appurtenances
   Recording Date: May 13, 1958
   Recording No.: G239607
   Affects: Portion of Lot 44 and other property

   Consent to Use Agreement;

   Recording Date: June 17, 2016
   Recording No.: 5294346

   and Re-Recording Date: July 12, 2016
   and Re-Recording No.: 5302803

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SCHEDULE B, PART II
EXCEPTIONS
(continued)

9. Covenants, conditions, restrictions and easements but omitting any covenants or restrictions, if any, including but not limited to those based upon race, color, religion, sex, sexual orientation, familial status, marital status, disability, handicap, national origin, ancestry, source of income, gender, gender identity, gender expression, medical condition or genetic information, as set forth in applicable state or federal laws, except to the extent that said covenant or restriction is permitted by applicable law, as set forth in the document

   Recording Date: December 5, 2017
   Recording No.: 5468232

   Including any unpaid assessments or charges and liability to further assessments or charges, for which a lien may have arisen (or may arise), all as provided for by said document.

   Modification(s) of said covenants, conditions and restrictions

   Recording Date: December 22, 2017
   Recording No.: 5473796

10. Covenants, conditions, restrictions, recitals, reservations, easements, easement provisions, dedications, building setback lines, notes, statements, and other matters, if any, but omitting any covenants or restrictions, if any, including but not limited to those based upon race, color, religion, sex, sexual orientation, familial status, marital status, disability, handicap, national origin, ancestry, or source of income, as set forth in applicable state or federal laws, except to the extent that said covenant or restriction is permitted by applicable law, as set forth on plat of Estates at the Archery:

    Recording No: Volume 311, Page 924

11. Any unrecorded leaseholds, right of vendors and holders of security interests on personal property installed upon the Land and rights of tenants to remove trade fixtures at the expiration of the terms.

END OF SCHEDULE B, PART II

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COMMITMENT CONDITIONS

1. DEFINITIONS

(a) "Knowledge" or "Known": Actual or imputed knowledge, but not constructive notice imparted by the Public Records.

(b) "Land": The land described in Schedule A and affixed improvements that by law constitute real property. The term "Land" does not include any property beyond the lines of the area described in Schedule A, nor any right, title, interest, estate, or easement in abutting streets, roads, avenues, alleys, lanes, ways, or waterways, but this does not modify or limit the extent that a right of access to and from the Land is to be insured by the Policy.

(c) "Mortgage": A mortgage, deed of trust, or other security instrument, including one evidenced by electronic means authorized by law.

(d) "Policy": Each contract of title insurance, in a form adopted by the American Land Title Association, issued or to be issued by the Company pursuant to this Commitment.

(e) "Proposed Insured": Each person identified in Schedule A as the Proposed Insured of each Policy to be issued pursuant to this Commitment.

(f) "Proposed Policy Amount": Each dollar amount specified in Schedule A as the Proposed Policy Amount of each Policy to be issued pursuant to this Commitment.

(g) "Public Records": Records established under state statutes at the Commitment Date for the purpose of imparting constructive notice of matters relating to real property to purchasers for value and without Knowledge.

(h) "Title": The estate or interest described in Schedule A.

2. If all of the Schedule B, Part I-Requirements have not been met within the time period specified in the Commitment to Issue Policy, this Commitment terminates and the Company's liability and obligation end.

3. The Company's liability and obligation is limited by and this Commitment is not valid without:

(a) the Notice;

(b) the Commitment to Issue Policy;

(c) the Commitment Conditions;

(d) Schedule A;

(e) Schedule B, Part I-Requirements;

(f) Schedule B, Part II-Exceptions; and

(g) a counter-signature by the Company or its issuing agent that may be in electronic form.

4. COMPANY'S RIGHT TO AMEND

The Company may amend this Commitment at any time. If the Company amends this Commitment to add a defect, lien, encumbrance, adverse claim, or other matter recorded in the Public Records prior to the Commitment Date, any liability of the Company is limited by Commitment Condition 5. The Company shall not be liable for any other amendment to this Commitment.

5. LIMITATIONS OF LIABILITY

(a) The Company's liability under Commitment Condition 4 is limited to the Proposed Insured's actual expense incurred in the interval between the Company's delivery to the Proposed Insured of the Commitment and the delivery of the amended Commitment, resulting from the Proposed Insured's good faith reliance to:

(i) comply with the Schedule B, Part I-Requirements;

(ii) eliminate, with the Company's written consent, any Schedule B, Part II-Exceptions; or

(iii) acquire the Title or create the Mortgage covered by this Commitment.

(b) The Company shall not be liable under Commitment Condition 5(a) if the Proposed Insured requested the amendment or had Knowledge of the matter and did not notify the Company about it in writing.

(c) The Company will only have liability under Commitment Condition 4 if the Proposed Insured would not have incurred the expense had the Commitment included the added matter when the Commitment was first delivered to the Proposed Insured.

(d) The Company's liability shall not exceed the lesser of the Proposed Insured's actual expense incurred in good faith and described in Commitment Conditions 5(a)(i) through 5(a)(iii) or the Proposed Policy Amount.

(e) The Company shall not be liable for the content of the Transaction Identification Data, if any.

(f) In no event shall the Company be obligated to issue the Policy referred to in this Commitment unless all of the Schedule B, Part I-Requirements have been met to the satisfaction of the Company.

(g) In any event, the Company's liability is limited by the terms and provisions of the Policy.

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(continued)

6. LIABILITY OF THE COMPANY MUST BE BASED ON THIS COMMITMENT

(a) Only a Proposed Insured identified in Schedule A, and no other person, may make a claim under this Commitment.

(b) Any claim must be based in contract and must be restricted solely to the terms and provisions of this Commitment.

(c) Until the Policy is issued, this Commitment, as last revised, is the exclusive and entire agreement between the parties with respect to the subject matter of this Commitment and supersedes all prior commitment negotiations, representations, and proposals of any kind, whether written or oral, express or implied, relating to the subject matter of this Commitment.

(d) The deletion or modification of any Schedule B, Part II-Exception does not constitute an agreement or obligation to provide coverage beyond the terms and provisions of this Commitment or the Policy.

(e) Any amendment or endorsement to this Commitment must be in writing and authenticated by a person authorized by the Company.

(f) When the Policy is issued, all liability and obligation under this Commitment will end and the Company's only liability will be under the Policy.

7. IF THIS COMMITMENT HAS BEEN ISSUED BY AN ISSUING AGENT

The issuing agent is the Company's agent only for the limited purpose of issuing title insurance commitments and policies. The issuing agent is not the Company's agent for the purpose of providing closing or settlement services.

8. PRO-FORMA POLICY

The Company may provide, at the request of a Proposed Insured, a pro-forma policy illustrating the coverage that the Company may provide. A pro-forma policy neither reflects the status of Title at the time that the pro-forma policy is delivered to a Proposed Insured, nor is it a commitment to insure.

END OF CONDITIONS

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RECORDING REQUIREMENTS

Effective January 1, 1997, document format and content requirements have been imposed by Washington Law. Failure to comply with the following requirements may result in rejection of the document by the county recorder or imposition of a $50.00 surcharge.

First page or cover sheet:

3" top margin containing nothing except the return address.

1" side and bottom margins containing no markings or seals.

Title(s) of documents.

Recording no. of any assigned, released or referenced document(s).

Grantors names (and page no. where additional names can be found).

Grantees names (and page no. where additional names can be found).

Abbreviated legal description (Lot, Block, Plat Name or Section, Township, Range and Quarter, Quarter Section for unplatted). Said abbreviated legal description is not a substitute for a complete legal description which must also appear in the body of the document.

Assessor's tax parcel number(s).

Return address (in top 3" margin).

**A cover sheet can be attached containing the above format and data if the first page does not contain all required data.

Additional Pages:

1" top, side and bottom margins containing no markings or seals.

All Pages:

No stapled or taped attachments. Each attachment must be a separate page. All notary and other pressure seals must be smudged for visibility. Font size of 8 points or larger.

WIRE SAFE™ | Inquire before you wire!

WIRE FRAUD ALERT

This Notice is not intended to provide legal or professional advice.
If you have any questions, please consult with a lawyer.

All parties to a real estate transaction are targets for wire fraud and many have lost hundreds of thousands of dollars because they simply relied on the wire instructions received via email, without further verification. **If funds are to be wired in conjunction with this real estate transaction, we strongly recommend verbal verification of wire instructions through a known, trusted phone number prior to sending funds.**

In addition, the following non-exclusive self-protection strategies are recommended to minimize exposure to possible wire fraud.

- **NEVER RELY** on emails purporting to change wire instructions. Parties to a transaction rarely change wire instructions in the course of a transaction.
- **ALWAYS VERIFY** wire instructions, specifically the ABA routing number and account number, by calling the party who sent the instructions to you. DO NOT use the phone number provided in the email containing the instructions, use phone numbers you have called before or can otherwise verify. **Obtain the number of relevant parties to the transaction as soon as an escrow account is opened.** DO NOT send an email to verify as the email address may be incorrect or the email may be intercepted by the fraudster.
- **USE COMPLEX EMAIL PASSWORDS** that employ a combination of mixed case, numbers, and symbols. Make your passwords greater than eight (8) characters. Also, change your password often and do NOT reuse the same password for other online accounts.
- **USE MULTI-FACTOR AUTHENTICATION** for email accounts. Your email provider or IT staff may have specific instructions on how to implement this feature.

For more information on wire-fraud scams or to report an incident, please refer to the following links:

Federal Bureau of Investigation:
http://www.fbi.gov

Internet Crime Complaint Center:
http://www.ic3.gov

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FIDELITY NATIONAL FINANCIAL
PRIVACY NOTICE

Effective April 9, 2020

Fidelity National Financial, Inc. and its majority-owned subsidiary companies (collectively, "FNF," "our," or "we") respect and are committed to protecting your privacy. This Privacy Notice explains how we collect, use, and protect personal information, when and to whom we disclose such information, and the choices you have about the use and disclosure of that information.

A limited number of FNF subsidiaries have their own privacy notices. If a subsidiary has its own privacy notice, the privacy notice will be available on the subsidiary's website and this Privacy Notice does not apply.

Collection of Personal Information

FNF may collect the following categories of Personal Information:

- contact information (e.g., name, address, phone number, email address);
- demographic information (e.g., date of birth, gender, marital status);
- identity information (e.g. Social Security Number, driver's license, passport, or other government ID number);
- financial account information (e.g. loan or bank account information); and
- other personal information necessary to provide products or services to you.

We may collect Personal Information about you from:

- information we receive from you or your agent;
- information about your transactions with FNF, our affiliates, or others; and
- information we receive from consumer reporting agencies and/or governmental entities, either directly from these entities or through others.

Collection of Browsing Information

FNF automatically collects the following types of Browsing Information when you access an FNF website, online service, or application (each an "FNF Website") from your Internet browser, computer, and/or device:

- Internet Protocol (IP) address and operating system;
- browser version, language, and type;
- domain name system requests; and
- browsing history on the FNF Website, such as date and time of your visit to the FNF Website and visits to the pages within the FNF Website.

Like most websites, our servers automatically log each visitor to the FNF Website and may collect the Browsing Information described above. We use Browsing Information for system administration, troubleshooting, fraud investigation, and to improve our websites. Browsing Information generally does not reveal anything personal about you, though if you have created a user account for an FNF Website and are logged into that account, the FNF Website may be able to link certain browsing activity to your user account.

Other Online Specifics

Cookies. When you visit an FNF Website, a "cookie" may be sent to your computer. A cookie is a small piece of data that is sent to your Internet browser from a web server and stored on your computer's hard drive. Information gathered using cookies helps us improve your user experience. For example, a cookie can help the website load properly or can customize the display page based on your browser type and user preferences. You can choose whether or not to accept cookies by changing your Internet browser settings. Be aware that doing so may impair or limit some functionality of the FNF Website.

Web Beacons. We use web beacons to determine when and how many times a page has been viewed. This information is used to improve our websites.

Do Not Track. Currently our FNF Websites do not respond to "Do Not Track" features enabled through your browser.

Links to Other Sites. FNF Websites may contain links to unaffiliated third-party websites. FNF is not responsible for the privacy practices or content of those websites. We recommend that you read the privacy policy of every website you visit.

Use of Personal Information

FNF uses Personal Information for three main purposes:

- To provide products and services to you or in connection with a transaction involving you.
- To improve our products and services.
- To communicate with you about our, our affiliates', and others' products and services, jointly or independently.

When Information Is Disclosed

We may disclose your Personal Information and Browsing Information in the following circumstances:

- to enable us to detect or prevent criminal activity, fraud, material misrepresentation, or nondisclosure;
- to nonaffiliated service providers who provide or perform services or functions on our behalf and who agree to use the information only to provide such services or functions;
- to nonaffiliated third party service providers with whom we perform joint marketing, pursuant to an agreement with them to jointly market financial products or services to you;
- to law enforcement or authorities in connection with an investigation, or in response to a subpoena or court order; or
- in the good-faith belief that such disclosure is necessary to comply with legal process or applicable laws, or to protect the rights, property, or safety of FNF, its customers, or the public.

The law does not require your prior authorization and does not allow you to restrict the disclosures described above. Additionally, we may disclose your information to third parties for whom you have given us authorization or consent to make such disclosure. We do not otherwise share your Personal Information or Browsing Information with nonaffiliated third parties, except as required or permitted by law. We may share your Personal Information with affiliates (other companies owned by FNF) to directly market to you. Please see "Choices with Your Information" to learn how to restrict that sharing.

We reserve the right to transfer your Personal Information, Browsing Information, and any other information, in connection with the sale or other disposition of all or part of the FNF business and/or assets, or in the event of bankruptcy, reorganization, insolvency, receivership, or an assignment for the benefit of creditors. By submitting Personal Information and/or Browsing Information to FNF, you expressly agree and consent to the use and/or transfer of the foregoing information in connection with any of the above described proceedings.

Security of Your Information

We maintain physical, electronic, and procedural safeguards to protect your Personal Information.

Choices With Your Information

If you do not want FNF to share your information among our affiliates to directly market to you, you may send an "opt out" request by email, phone, or physical mail as directed at the end of this Privacy Notice. We do not share your Personal Information with nonaffiliates for their use to direct market to you without your consent.

Whether you submit Personal Information or Browsing Information to FNF is entirely up to you. If you decide not to submit Personal Information or Browsing Information, FNF may not be able to provide certain services or products to you.

For California Residents: We will not share your Personal Information or Browsing Information with nonaffiliated third parties, except as permitted by California law. For additional information about your California privacy rights, please visit the "California Privacy" link on our website (https://fnf.com/pages/californiaprivacy.aspx) or call (888) 413-1748.

For Nevada Residents: You may be placed on our internal Do Not Call List by calling (888) 934-3354 or by contacting us via the information set forth at the end of this Privacy Notice. Nevada law requires that we also provide you with the following contact information: Bureau of Consumer Protection, Office of the Nevada Attorney General, 555 E. Washington St., Suite 3900, Las Vegas, NV 89101; Phone number: (702) 486-3132; email: BCPINFO@ag.state.nv.us.

For Oregon Residents: We will not share your Personal Information or Browsing Information with nonaffiliated third parties for marketing purposes, except after you have been informed by us of such sharing and had an opportunity to indicate that you do not want a disclosure made for marketing purposes.

For Vermont Residents: We will not disclose information about your creditworthiness to our affiliates and will not disclose your personal information, financial information, credit report, or health information to nonaffiliated third parties to market to you, other than as permitted by Vermont law, unless you authorize us to make those disclosures.

Information From Children

The FNF Websites are not intended or designed to attract persons under the age of eighteen (18). We do not collect Personal Information from any person that we know to be under the age of thirteen (13) without permission from a parent or guardian.

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Fidelity National Financial, Inc.
601 Riverside Avenue,
Jacksonville, Florida 32204
Attn: Chief Privacy Officer

Fidelity National Title

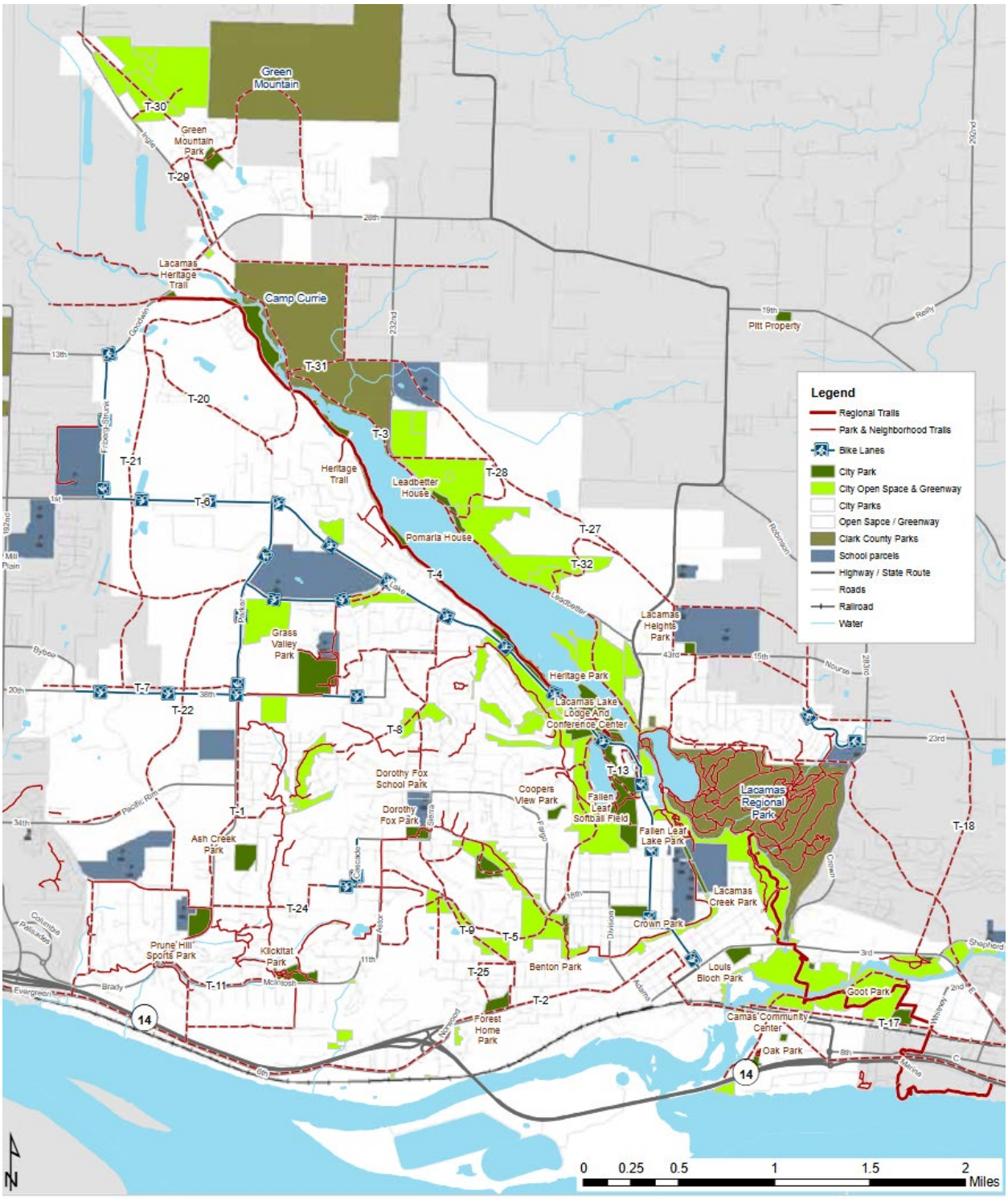
COMPANY OF WASHINGTON, INC.

EXHIBIT "A"

Order No.: 612876055

For APN/Parcel ID(s): 986043913 and 986043914

Lot(s) 43 and 44, ESTATES AT THE ARCHERY, according to the plat thereof, recorded in Volume 311 of Plats, Page 924, records of Clark County, Washington.



Map 8: Potential Trails


NW Pittock Pl
NW Camas Meadows Dr
NW Longview Ln
NW McMaster Dr

AFTER RECORDING, RETURN TO:

James D. Howsley
Jordan Ramis PC
1211 SW Fifth Ave., 27th Floor
Portland, OR 97204

Space Above for Recording Information Only

FIRST AMENDMENT TO DEVELOPMENT AGREEMENT

This First Amendment to Development Agreement (the "First Amendment") is made and entered into by and between the CITY OF CAMAS, a Washington Municipal Corporation (hereinafter referred to as the "City"), and Vestcapital Fund II, LLC and MAS1A, LLC (hereinafter referred to as the "Owners") (and collectively referred to as "Parties").

RECITALS

WHEREAS, the City and the Owners' predecessors executed that certain Development Agreement recorded as Document No. 5268706 AGR on March 28, 2016 ("Original Development Agreement"); and Owners own certain real property that is located within the City's municipal boundary and that is more fully described within the Master Plan and attached Exhibit "A", (hereinafter referred to as the "Property"); and,

WHEREAS, the Property is within the Mixed Use Planned Development Overlay which requires approval of a Master Plan and a Development Agreement; and

WHEREAS, the Original Development Agreement has a ten year term that extends to March 27, 2026 and thus remains in effect; and

WHEREAS, most of the area of the Original Master Plan has been successfully developed, with infrastructure to serve the Property; and

WHEREAS, the Parties desire to replace the Original Development with a revised Master Plan applicable to the Property, and desire to extend the original term to allow ten more years for completion of the revised project.

NOW, THEREFORE, THE PARTIES HERETO AGREE AS FOLLOWS:

Section 1. Development Agreement. This Agreement is a Development Agreement to be implemented under the authority of and in accordance with RCW 36.70B.170 through RCW 36.70B.210. It shall become a contract between the Owner and the City upon its approval by ordinance or resolution following a public hearing as provided for in RCW 36.70B.170; and upon execution by all parties.

Section 2. Term of Agreement. This First Amendment shall commence upon the Effective Date, and it, together with the Original Development Agreement, shall be valid for a period of ten (10) years; unless extended or terminated by mutual consent of the Parties; provided however, if this First Amendment or any initial land use applications related to the Property and filed within one year of the effective date of this First Amendment, are appealed, the term of this Agreement shall be tolled for the time during which the appeal is pending or eighteen (18) months, whichever is less. The "Effective Date" shall be the date of recording, which shall occur within thirty days of the date of the adopting Resolution.

Section 3. Vesting. Any land use applications submitted with respect to the Property during the term of this First Amendment, shall be vested to the following land use regulations and Development Standards in effect on the effective date of this First Amendment: CMC Title 16.0116.21; CMC 16.31; CMC Title 17 and CMC Title 18 (through Ordinance 24-007), unless otherwise provided for in this First Amendment through Exhibit "B" Dimensional Standards or Exhibit "C" Master Plan. Any land use approvals affecting the Property issued after the effective date of this First Amendment shall remain in effect during the term of this First Amendment; provided however, that preliminary plat approvals shall be valid for a period of seven years from the date of the approval, regardless of whether the end of such seven years occurs during or after the term of this First Amendment. The vesting provided for under this First Amendment shall not apply to System Development Charges, Impact Fees or application or review fees, which shall be assessed at the then-current rates.

Section 4. Master Plan. Parties agree to incorporate by reference Exhibit C The Proposed Site Plan as the Master Plan for development of the Property. The Master Plan provides the Parties with predictability regarding the future development of the Property. Minimum dimensional standards that the Owner shall utilize for development under the Master Plan are provided for in Exhibit "B". Owner agrees to make best efforts to obtain permits and construct a public pocket park consistent with the Master Plan. Consistent with Camas Municipal Code (CMC) 18.09.060 D, the lot size, width, depth and setback standards shown on Exhibit "B" are herein negotiated consistent with the preservation of open space in the pocket park. The Property may be developed with a maximum 11 single family lots, and maximum 2 duplexes. A number of studies have been completed that aided in the Master Plan as well as the subdivision application already submitted to the city. Those studies include:

Phase 1 Environmental Site Assessment, Columbia West Engineering, Inc., August 31, 2015.

Existing Conditions & Boundary Survey — without Trees (Sheets 1 and 2), Minister Glaeser Surveying, Inc., December 10, 2015.

Existing Conditions & Boundary Survey — with Trees (Sheets 1 and 2), Minister-Glaeser Surveying, Inc., December 10,2015.

City of Camas Archaeological Predetermination Survey of 542 NW 218th Ave, Camas, Washington, Applied Archaeological Research, Inc., March 17, 2015.

Parklands Executive Residential Subdivision and Parklands Business Park: Preliminary Stormwater Design Report (TIR), Kessi Consulting, January 24, 2016.

Parklands at Camas Meadows Traffic Impact Study, H. Lee & Associates, November 18, 2015.

Wetland Delineation Report for Parklands at Camas Meadows Camas (Final Report), Washington, Ecological Land Services, Inc., December 15, 2015.

Geotechnical Site Investigation Parklands at Camas Meadows Camas, Washington, Columbia West Engineering, Inc., June 23, 2015.

Section 4.1. SEPA. The City issued a SEPA determination of nonsignificance regarding the Original Agreement (SEPA 15-14). Impacts that are identified at future stages of the development, including but not limited to, Site Plan approval, Preliminary Plat approval, Short Plat approval or building permit approvals that have been previously analyzed through this or other SEPA processes, shall not be re-analyzed on the condition that the future identified adverse impacts, in the sole discretion of the City, are substantially similar to and of the same or less intensity as those previously analyzed under this or other SEPA processes. Nothing in this Section shall preclude the City from requesting information, at the cost of the Owner, on the potential adverse environmental impacts associated with a specific land use application that have not been previously identified or analyzed as required under the State Environmental Policy Act.

Section 4.2. Streetscape. Owner agrees to incorporate into its development application submittal package streetscape standards for primary streets within the Property addressing street specifications, tree spacing and species, sidewalk separation, trash receptacles, benches and other street amenities that will create an inviting, safe passage for not only vehicular but pedestrian and bicycle traffic. Double frontage lots along NW Camas Meadows Drive are subject to the landscape and fencing requirements of CMC 17.19.030.D.6. The City will allow a deviation to these requirements, provided that the owner installs a sight-obscuring fence or masonry wall along the rear line of any lots backing NW Camas Meadows Drive in-lieu of the CMC requirements. The fence or wall shall comply with the City's Gateway Collector and Arterial Fence design detail or an alternative design of equal or better standard approved at the City's discretion. The owner also agrees to plant at least two minimum two-inch caliper trees per lot, of a species approved by the City, in the rear yard of any lots backing NW Camas Meadows Drive. Duplex lots are subject to CMC 17.19.030.C1, to include a five-foot-wide landscape buffer along the bordering single family lots. This landscape buffer consists of high shrubs to form a continuous screen and ninety-five percent opaque year-round.

Section 4.3. Pocket Park. Owner agrees to incorporate into its development application submittal package documents and plans for the pocket park identified as "Tract C New Public Park" on Exhibit C. The documents and plans shall include (1) assurance for completion of the park improvements prior to recording of the final subdivision plat; (2) the park Tract C shall be owned and maintained by an HOA but shall be publicly accessible; (3) a minimum of contiguous

15,000 sq. ft. of area; (4) a minimum of 3,000 sq. ft. play area with equipment suitable for and developmentally appropriate for toddlers and elementary school-aged children; (5) a minimum of one picnic table and two benches; (6) landscaping shall include an open turf area and shade trees; and (7) a minimum 8 ft. wide asphalt or concrete trail providing access to the edge of wetland Tract A. No off-street parking is required for the park. The owner agrees to install two solar-powered, rectangular rapid-flashing beacons at the west pedestrian crosswalk of the intersection of NW McMaster Drive and NW Camas Meadows Drive.

Section 5. Remedies. Should a disagreement arise between the City and Owner regarding the interpretation and application of this First Amendment, the parties agree to attempt to resolve the disagreement by first meeting and conferring. If such meeting proves unsuccessful to resolve the dispute, the disagreement may be resolved by judicial action filed in the Clark County Superior Court.

Section 6. Performance. Failure by either party at any time to require performance by the other party of any of the provisions hereof shall in no way affect the parties' rights hereunder to enforce the same, nor shall any waiver by a party of the breach hereof be held to be a waiver of any succeeding breach or a waiver of this non-waiver clause.

Section 7. Venue. This First Amendment shall be construed in accordance with and, governed by, the laws of the State of Washington. The parties agree to venue in the Superior Court for Clark County, State of Washington, to resolve any disputes that may arise under this First Amendment.

Section 8. Severability. If any portion of this First Amendment shall be invalid or unenforceable to any extent, the validity of the remaining provisions shall not be affected thereby.

Section 9. Inconsistencies. If any provisions of the Camas Municipal Code or Master Plan are deemed inconsistent with the provisions of this First Amendment, the provisions of this First Amendment shall prevail.

Section 10. Binding on Successors and Recording. The rights and obligations created by this First Amendment are assignable and shall be binding upon and inure to the benefit of Owner, the City, and their respective heirs, successors and assigns. Only Owners and the City or their assigns shall have the right to enforce the terms of this First Amendment. This First Amendment shall be recorded against the Property with the Clark County Auditor. Pursuant to RCW 36.70B.170(4), the City reserves the authority to impose new or different regulations to the extent required by a serious threat to public health and safety.

Section 11. Recitals. Each of the recitals contained herein are intended to be, and are incorporated as, covenants between the parties and shall be so construed.

CITY OF CAMAS

By: _____

Name: STEVEN C. HOGAN

Title: Mayor

Date: May 8th, 2025

MAS1A, LLC

By: _____

Name: JON ELLSWORTH

Title: MANAGING MEMBER

Date: 5/9/25

VESTCAPITAL FUND II, LLC

By: _____

Name: Louis C. DEFORD

Title: MANAGER / MEMBER

Date: 5/9/25

STATE OF WASHINGTON)
) ss.
County of Clark)

I certify that I know or have satisfactory evidence that Kevin DeFord is the Person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute this instrument and acknowledged it as the _____ of MAS1A, LLC to be free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED: 5/9/25

DAVID LOUBEY
Notary Public
State of Washington
Commission Number 23024731
My Commission Expires
09/06/2027

NOTARY PUBLIC for the State of Washington,
Residing in the County of Clark
My Commission Expires: 9/6/27

STATE OF WASHINGTON)
) ss.
County of Clark)

I certify that I know or have satisfactory evidence that Jon Ellsworth is the Person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute this instrument and acknowledged it as the _____ of VestCapital Fund, LLC to be free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED: 5/9/25

DAVID LOUBEY
Notary Public
State of Washington
Commission Number 23024731
My Commission Expires
09/06/2027

NOTARY PUBLIC for the State of Washington,
Residing in the County of Clark
My Commission Expires: 9/6/27

STATE OF WASHINGTON)
) ss.
County of Clark)

I certify that I know or have satisfactory evidence that Steve Hogan is the Person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute this instrument and acknowledged it as the Mayor of City of Camas, WA to be free and voluntary act of such party for the uses and purposes mentioned in the instrument.

DATED: May 8, 2025

Sydney Maelynn Baker
NOTARY PUBLIC for the State of Washington,
Residing in the County of Clark
My Commission Expires: 12/3/2025

NOTARY PUBLIC
STATE OF WASHINGTON
SYDNEY MAELYNN BAKER
MY COMMISSION EXPIRES
DECEMBER 03, 2025
COMMISSION # 22002109

EXHIBIT A: PROPERTY DESCRIPTION

Lot 43, Lot 44, and adjusted Lot 45 of the Estates at the Archery subdivision, recorded at Book 311, Page 924 of Clark County Book of Plats, in the SE & SW 1/4 of Sec. 28, T2N, R3E, W.M., Clark County, WA.

The abbreviated legal descriptions for the three parcels is:

Lot 43 (Parcel 986043913)

ESTATES AT THE ARCHERY LOT 44 311924

Lot 44 (Parcel 986043914)

ESTATES AT THE ARCHERY LOT 44 311924

Adjusted Lot 45 (Parcel 986043915)

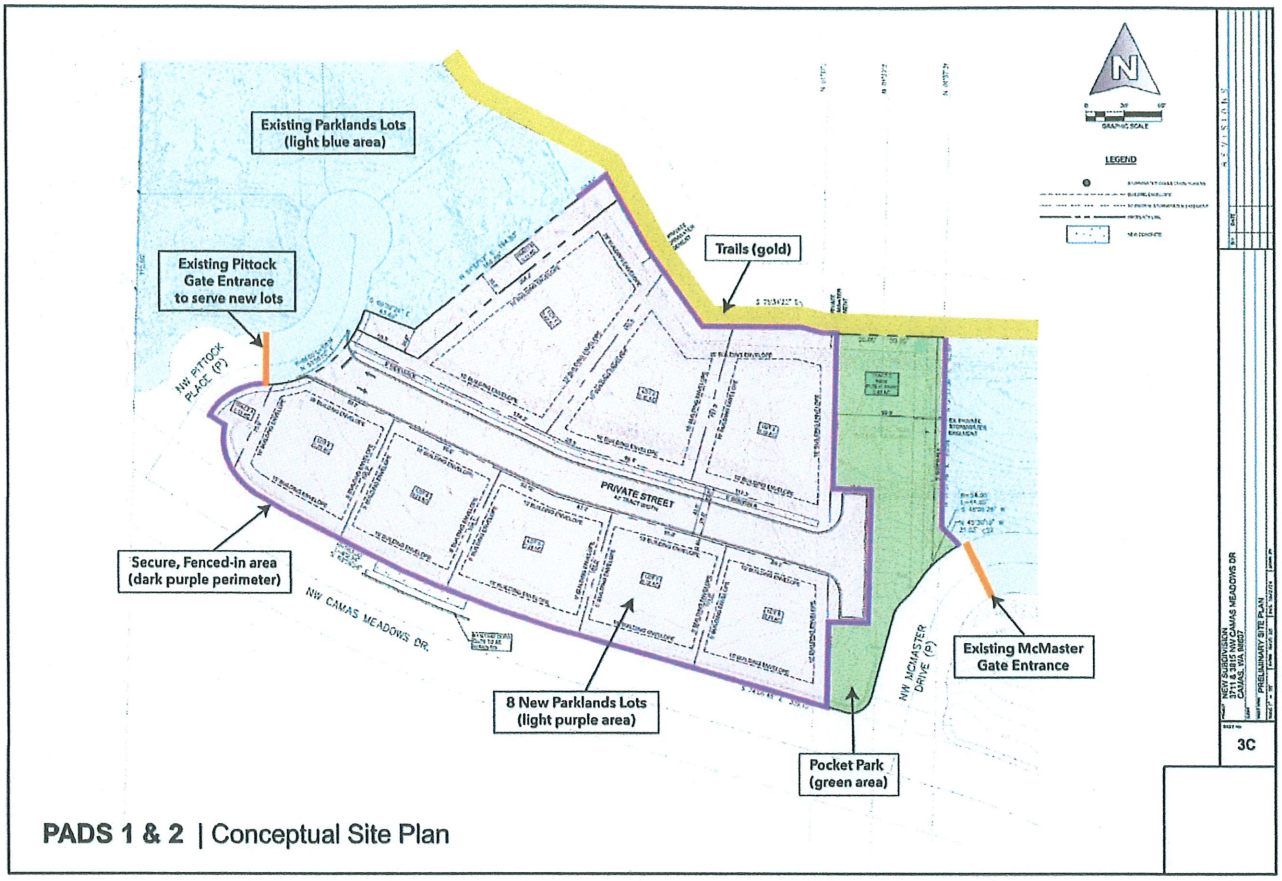
ESTATES AT THE ARCHERY ADJ LOT 45 311924

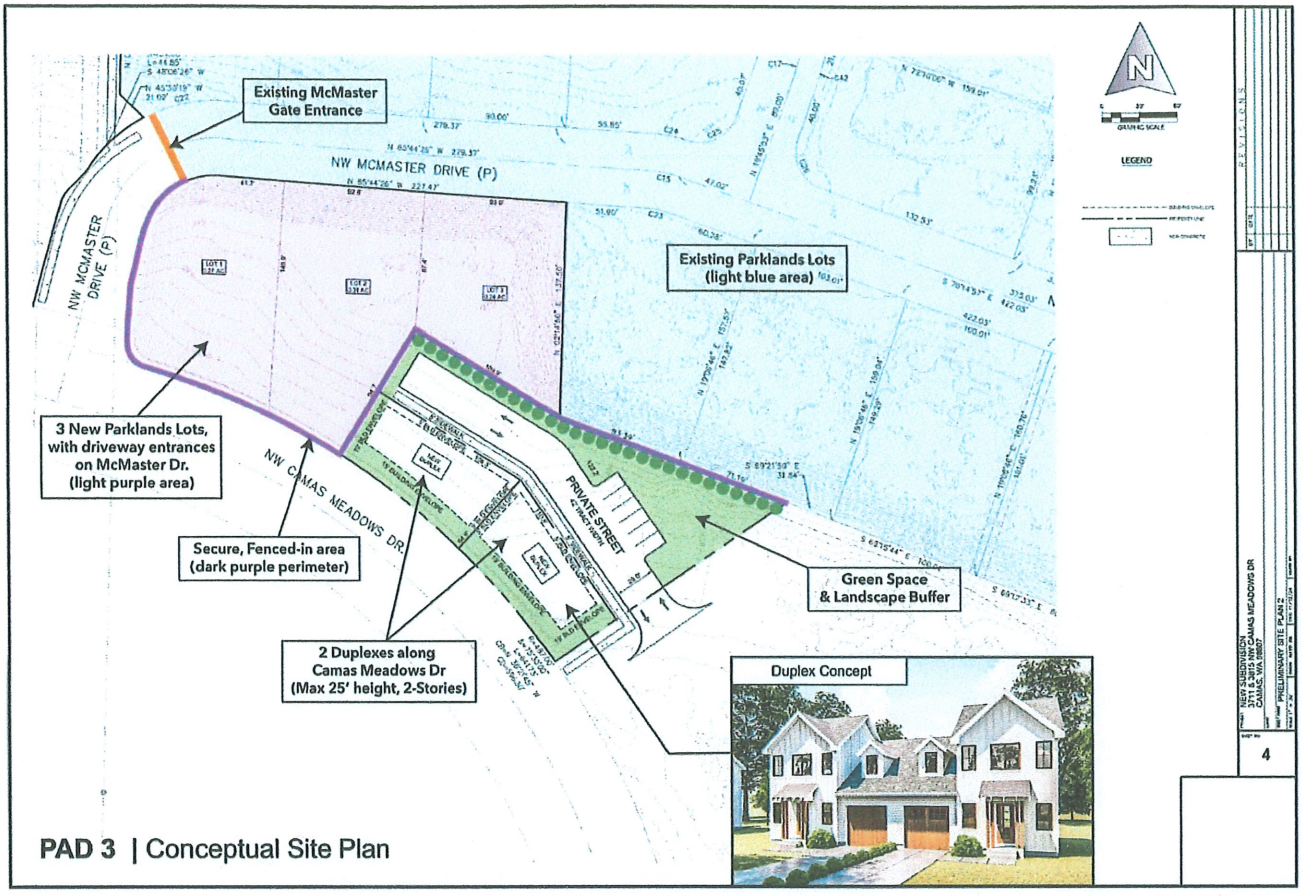
EXHIBIT "B" DIMENSIONAL STANDARDS

The Master Plan will implement the following development standards that provide for flexibility in creating a high-quality design. The master plan includes 11 single-family lots and 2 duplexes.

Development Standard	Single Family	Duplex
A. New Lot Dimensions		
Minimum lot size (square feet)	8,000	2,100
Maximum lot size (square feet)	No Limitation	No Limitation
Minimum lot width (feet)	80	26
Minimum lot depth (feet)	90	60
Maximum building lot coverage	50% (60% with ADU)	65%
Maximum building height (feet)	35	25; up to two stories
B. Setbacks		
Minimum front yard (feet)	15	10
Minimum garage (feet)	20	15
Minimum side yard flanking a street and corner lot rear yard (feet)	5	15
Minimum side yard at street (feet)	10 (5 with ADU or accessory buildings)	15

EXHIBIT "C" PROPOSED SITE PLAN




Existing McMaster Gate Entrance
NW MCMASTER DRIVE (P)
NW MCMASTER DRIVE (P)
Existing Parklands Lots (light blue area)
3 New Parklands Lots, with driveway entrances on McMaster Dr. (light purple area)
NW CAMAS MEADOWS DR
Secure, Fenced-in area (dark purple perimeter)
PRIVATE STREET
Green Space & Landscape Buffer
2 Duplexes along Camas Meadows Dr (Max 25' height, 2-Stories)
Duplex Concept
LEGEND
4
PAD 3 | Conceptual Site Plan

DEVELOPER'S PACKET

Produced By:

Clark County Geographic Information System (GIS)

For:

SGA Engineering- Parklands II

Subject Property Account Number(s):

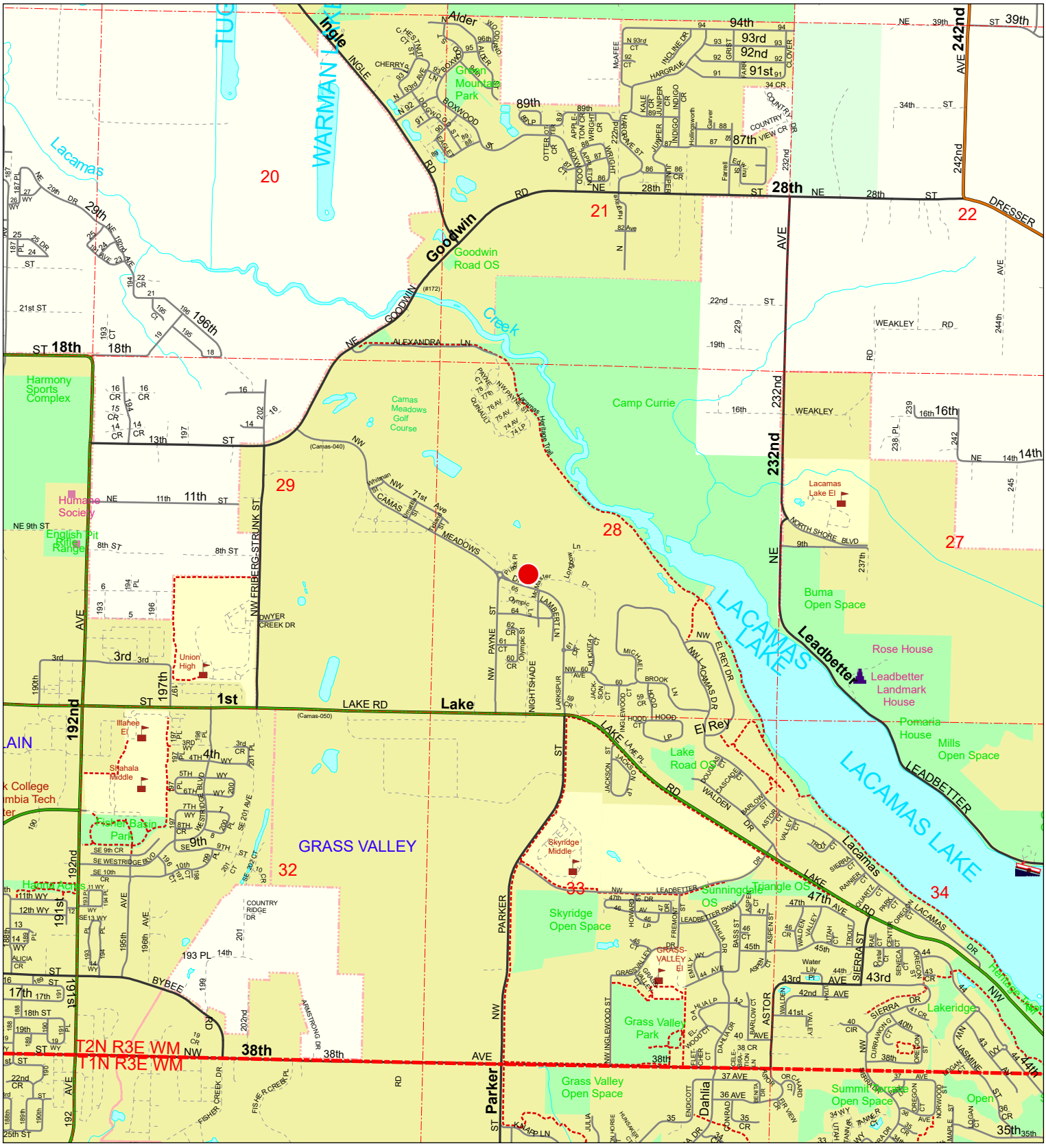
986043914
986043913

PDF # 313144

Printed: November 04, 2025
Expires: November 04, 2026

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General Location

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Location of Subject Property(s)

CLARK COUNTY, WASHINGTON
Geographic Information System

0 1,000 2,000 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Property Information Fact Sheet

Mailing Information:
Account No.: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607
Assessed Parcel Size: 3.24 Ac
Property Type: UNUSED PLATTED LAND.

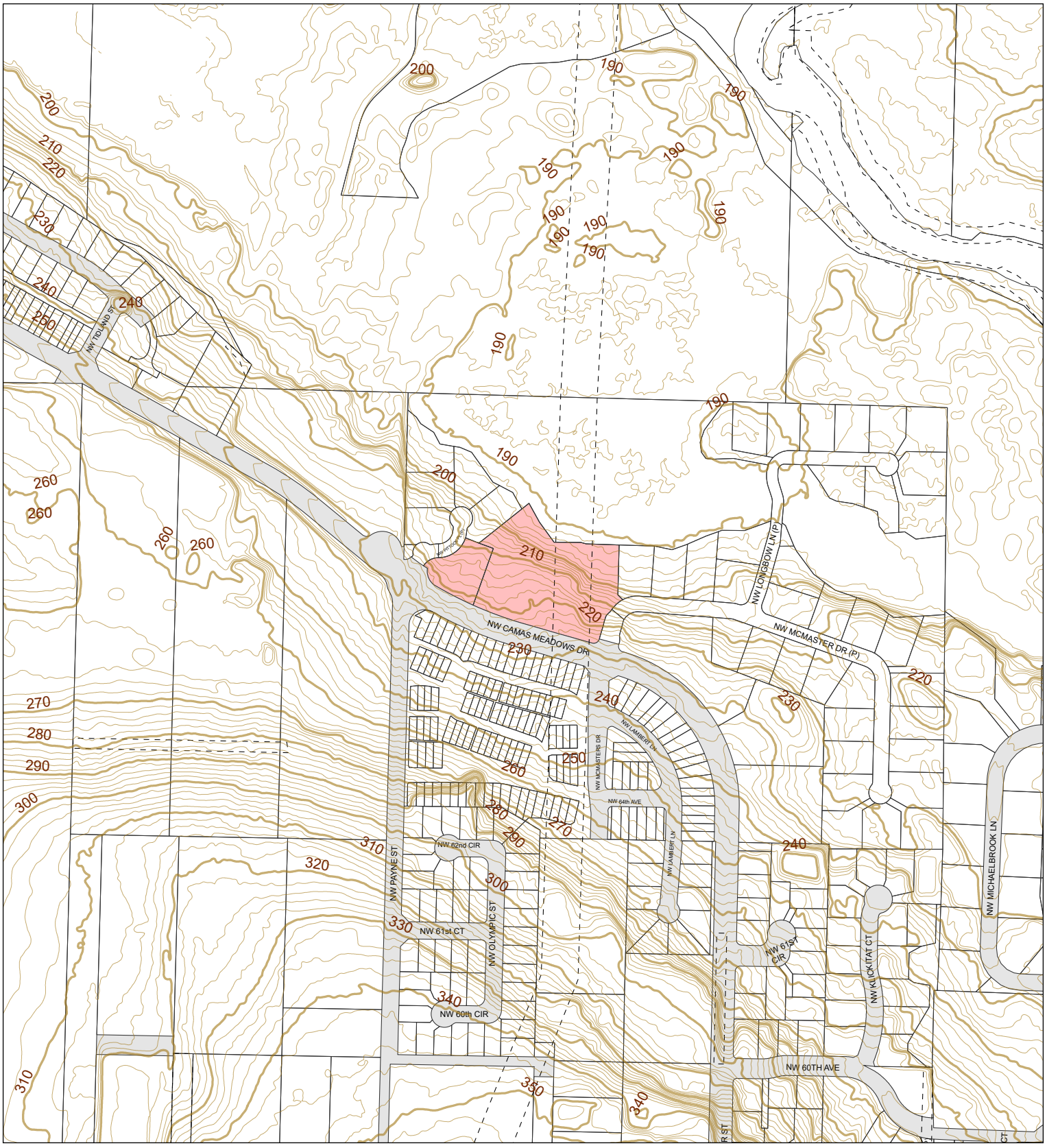
PARCEL LOCATION FINDINGS:

Quarter Section(s): SW 1/4,S28,T2N,R3E
Municipal Jurisdiction: Camas
Urban Growth Area: Camas
Zoning: BP, R-15
Zoning Overlay: No Mapping Indicators
Comprehensive Plan Designation: IND, SFL
Columbia River Gorge NSA: No Mapping Indicators
Late-Comer Area: No Mapping Indicators
Trans. Impact Fee Area: Camas
Park Impact Fee District: No Mapping Indicators
Neighborhood Association: No Mapping Indicators
School District: Camas
Elementary School: Grass Valley
Junior High School: Skyridge Middle
Senior High School: Camas
Fire District: City of Camas
Sewer District: Camas
Water District: Camas
Wildfire Danger Area: No Mapping Indicators

ENVIRONMENTAL CONSTRAINTS:

Soil Type(s): HcB, 11.6% of parcel
HcD, 88.4%
Hydric Soils: Non-Hydric, 100.0% of parcel
Flood Zone Designation: Outside Flood Area, 500 Year Flood Area
CARA: Category 2 Recharge Areas
Forest Moratorium Area: No Mapping Indicators
Liquefaction Susceptibility: Very Low
NEHRP: C
Slope: 0 - 5 percent, 0.8% of parcel
10 - 15 percent, 32.1%
15 - 25 percent, 14.6%
5 - 10 percent, 52.4%
Landslide Hazards: Slopes > 15%
Slope Stability: No Mapping Indicators
Cultural Resources:
Archeological Predictive: High, 34.0% of parcel
Moderate-High, 66.0%
Archeological Site Buffers: Mapping Indicators Found
Historic Sites: No Mapping Indicators

Information shown on this page was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



Elevation Contours

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

CLARK COUNTY, WASHINGTON
Geographic Information System

N

0 200 400 Feet

Subject Property(s)
Public Road
Transportation or Major Utility Easement
10' Elevation Contours
2' Elevation Contours

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



CLARK COUNTY, WASHINGTON
Geographic Information System

0 200 400 Feet

N

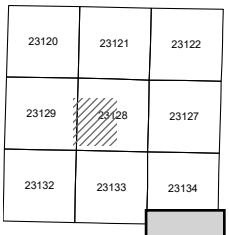
Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

2023 Aerial Photography

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Subject Property(s)

Printed on: November 04, 2025





2023 Aerial Photography with Elevation Contours

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

CLARK COUNTY, WASHINGTON
Geographic Information System

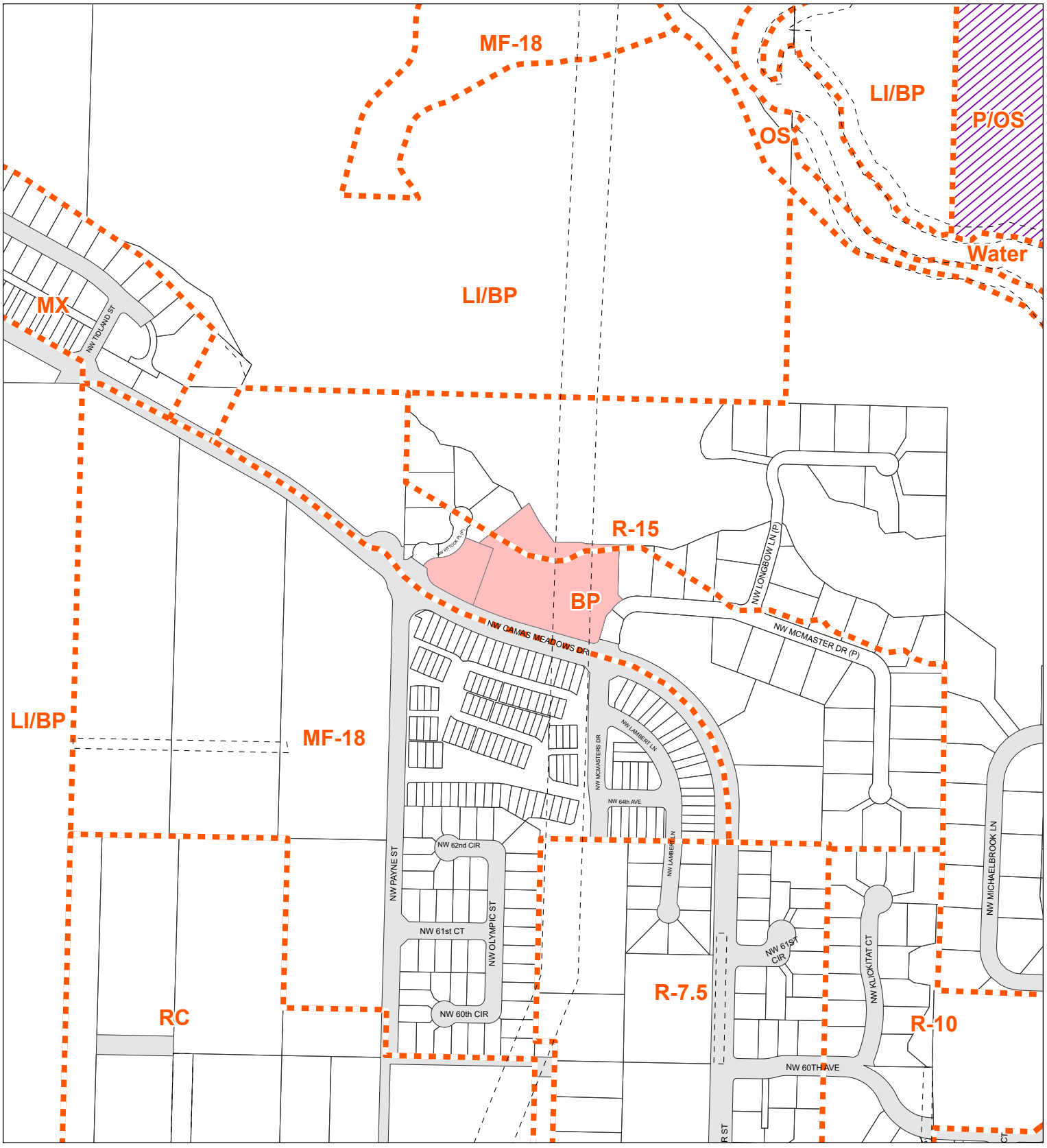
N

0 100 200 Feet

2' Elevation Contours
Subject Property(s)

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



CLARK COUNTY, WASHINGTON

Geographic Information System

0 200 400 Feet

N

Zoning Designations

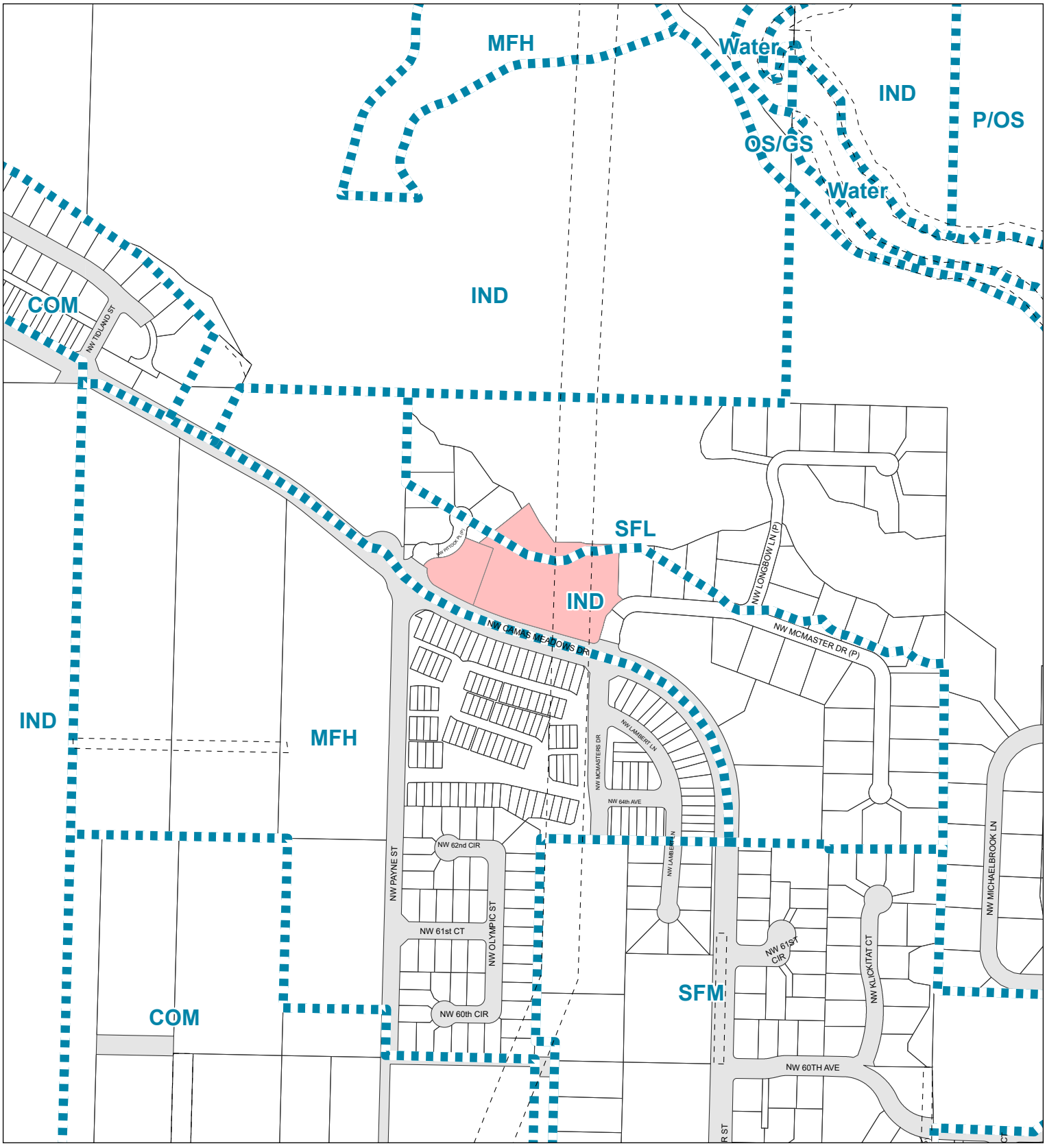
Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Printed on: November 04, 2025

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Zoning Boundary
- Urban Holding - 10 (UH-10)
- Urban Holding - 20 (UH-20)
- Urban Holding - 40 (UH-40)
- Surface Mining Overlay District

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



Comprehensive Plan Designations

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Printed on: November 04, 2025

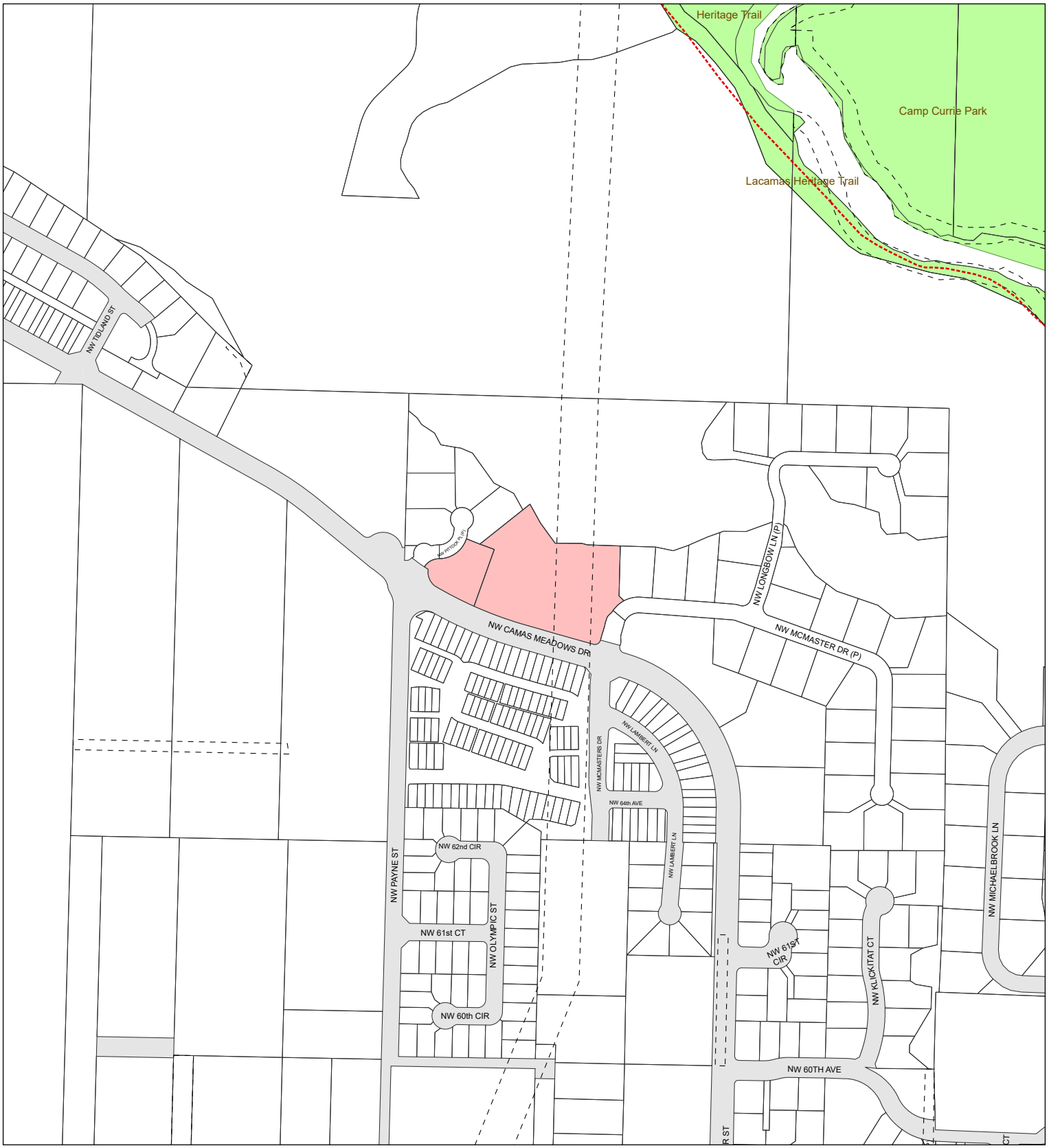
CLARK COUNTY, WASHINGTON
Geographic Information System

0 200 400 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Comprehensive Plan Boundary
- Urban Reserve
- Industrial Reserve
- Railroad Industrial Reserve
- Mining
- Rural Center Mixed Use
- Columbia River Gorge Scenic Area

23120	23121	23122
23129	23128	23127
23132	23133	23134



Arterials, C-Tran Bus Routes, Parks & Trails

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

CLARK COUNTY, WASHINGTON
Geographic Information System

0 200 400 Feet

N

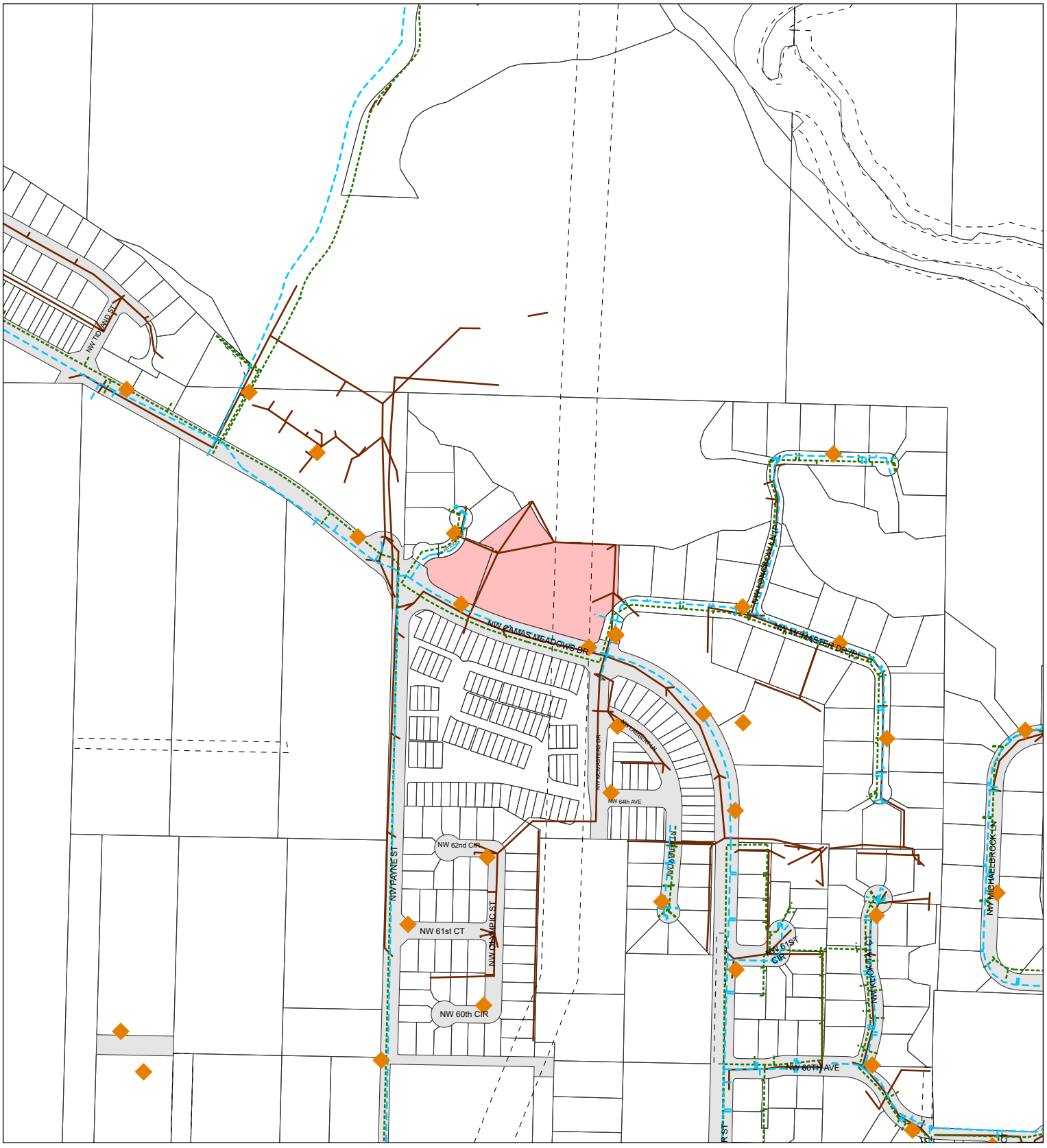
Subject Property(s)
Public Road
Transportation or Major Utility Easement
Parks
Trail
C-Tran Route

ClassPrimary
Principal Arterial
Minor Arterial
Collector
Rural Major Collector
Rural Minor Collector

State Route
Other
Proposed Arterial
Scenic Highway

23120	23121	23122
23129	23128	23127
23132	23133	23134

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CLARK COUNTY, WASHINGTON

Geographic Information System

N

0 200 400 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

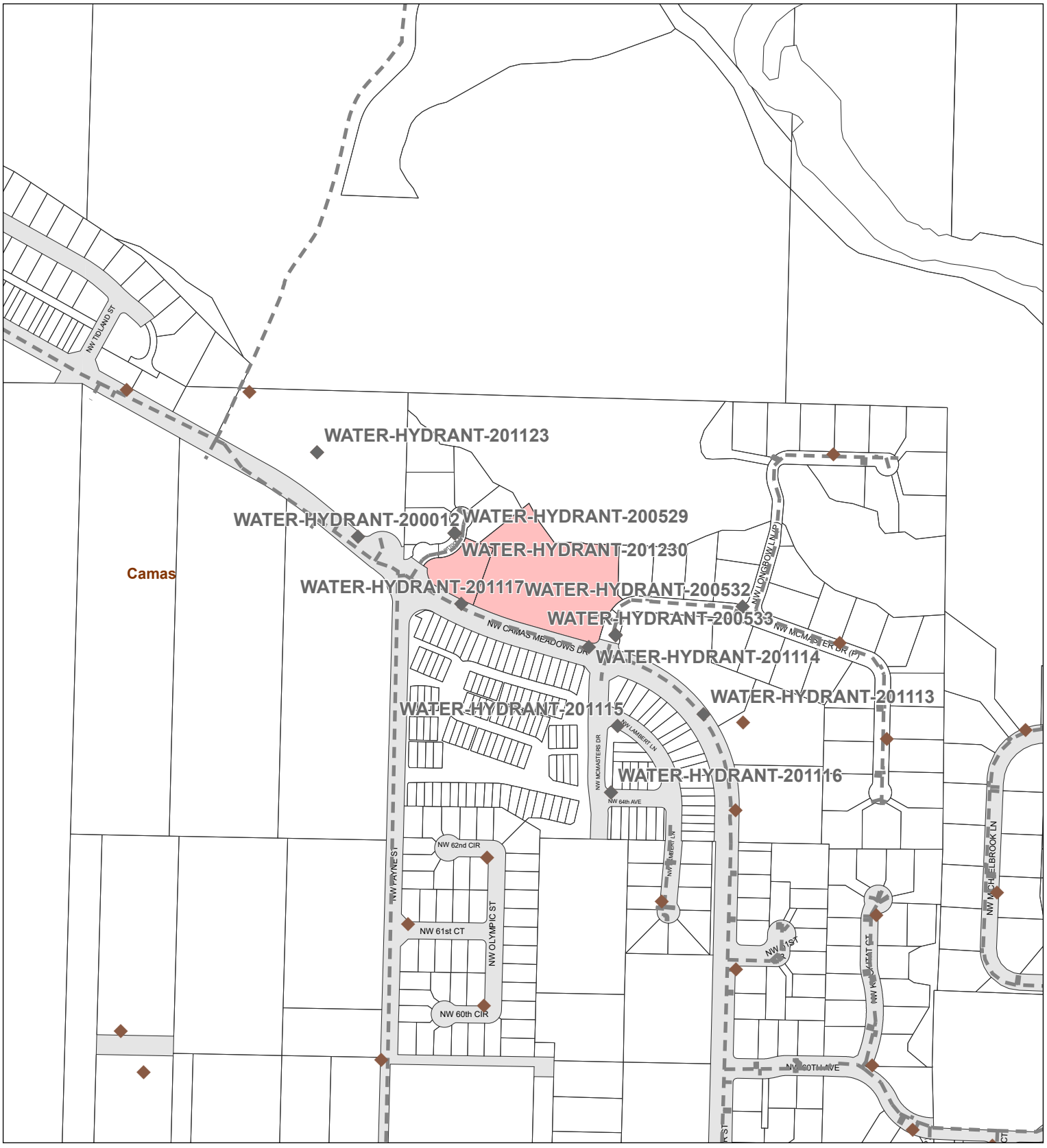
Water, Sewer, and Storm Systems

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Printed on: November 04, 2025

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- 1-Year Wellhead ZOC
- 5-Year Wellhead ZOC
- 10-Year Wellhead ZOC
- Water Lines
- Sewer Lines
- Storm Water Lines
- Hydrants

23120	23121	23122
23129	23128	23127
23132	23133	23134



Water Systems

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Printed on: November 04, 2025

CLARK COUNTY, WASHINGTON
Geographic Information System

0 200 400 Feet

N

Subject Parcel
Public Road
Water District Boundary
Unknown Size Water Line
< 10" Water LIne
10-20" Water Line
> 20" Water Line
No Flow Data Hydrant
0 - 499 GPM at 20 PSI
500 - 999 GPM at 20 PSI
> 1000 - 1749 GPM at 20 PSI
> 1750 GPM at 20 PSI
Hydrant > 500' from parcel(s)

23120	23121	23122
23129	23128	23127
23132	23133	23134

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Hydrant Fire Flow Details

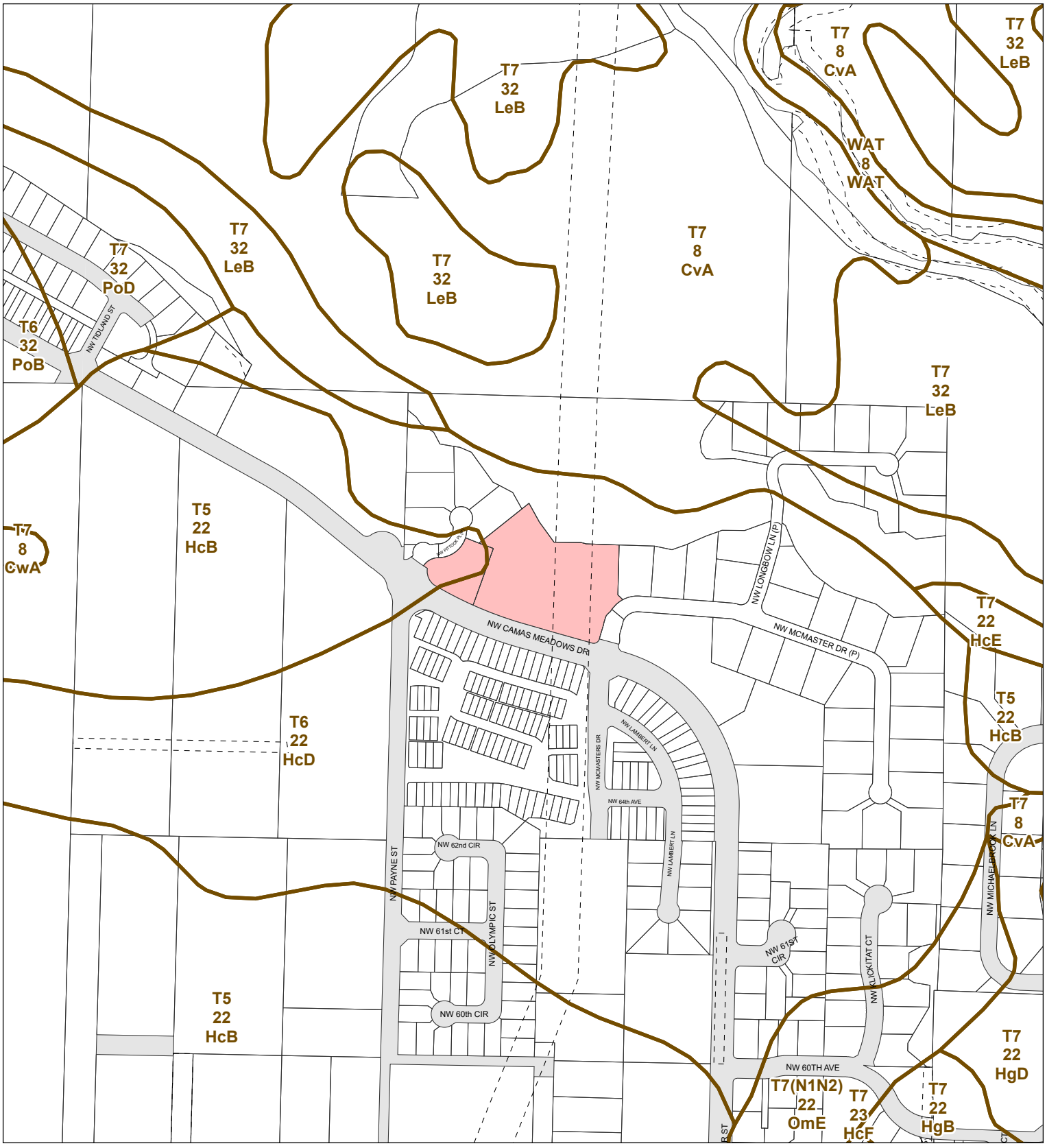
Account No.: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Water District(s)	Hydrant Data Update	Project Site Provider
Camas	October 18, 2023	Service Provider

HYDRANT INFORMATION:

Hydrant ID	Hydrant Owner	Main Diameter	Flow at 20 PSI	Test Date	Distance to site
WATER-HYDRANT-201117	Camas	0.0"	No Data		11 ft
WATER-HYDRANT-201114	Camas	0.0"	No Data		15 ft
WATER-HYDRANT-200529	Camas	0.0"	No Data		33 ft
WATER-HYDRANT-201230	Camas	0.0"	No Data		35 ft
WATER-HYDRANT-201229	Camas	0.0"	No Data		43 ft
WATER-HYDRANT-200533	Camas	0.0"	No Data		44 ft
WATER-HYDRANT-200012	Camas	0.0"	No Data		217 ft
WATER-HYDRANT-201115	Camas	0.0"	No Data		261 ft
WATER-HYDRANT-200532	Camas	0.0"	No Data		365 ft
WATER-HYDRANT-201113	Camas	0.0"	No Data		389 ft
WATER-HYDRANT-201116	Camas	0.0"	No Data		456 ft
WATER-HYDRANT-201123	Private	0.0"	No Data		470 ft

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CLARK COUNTY, WASHINGTON

Geographic Information System

N

0 200 400 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

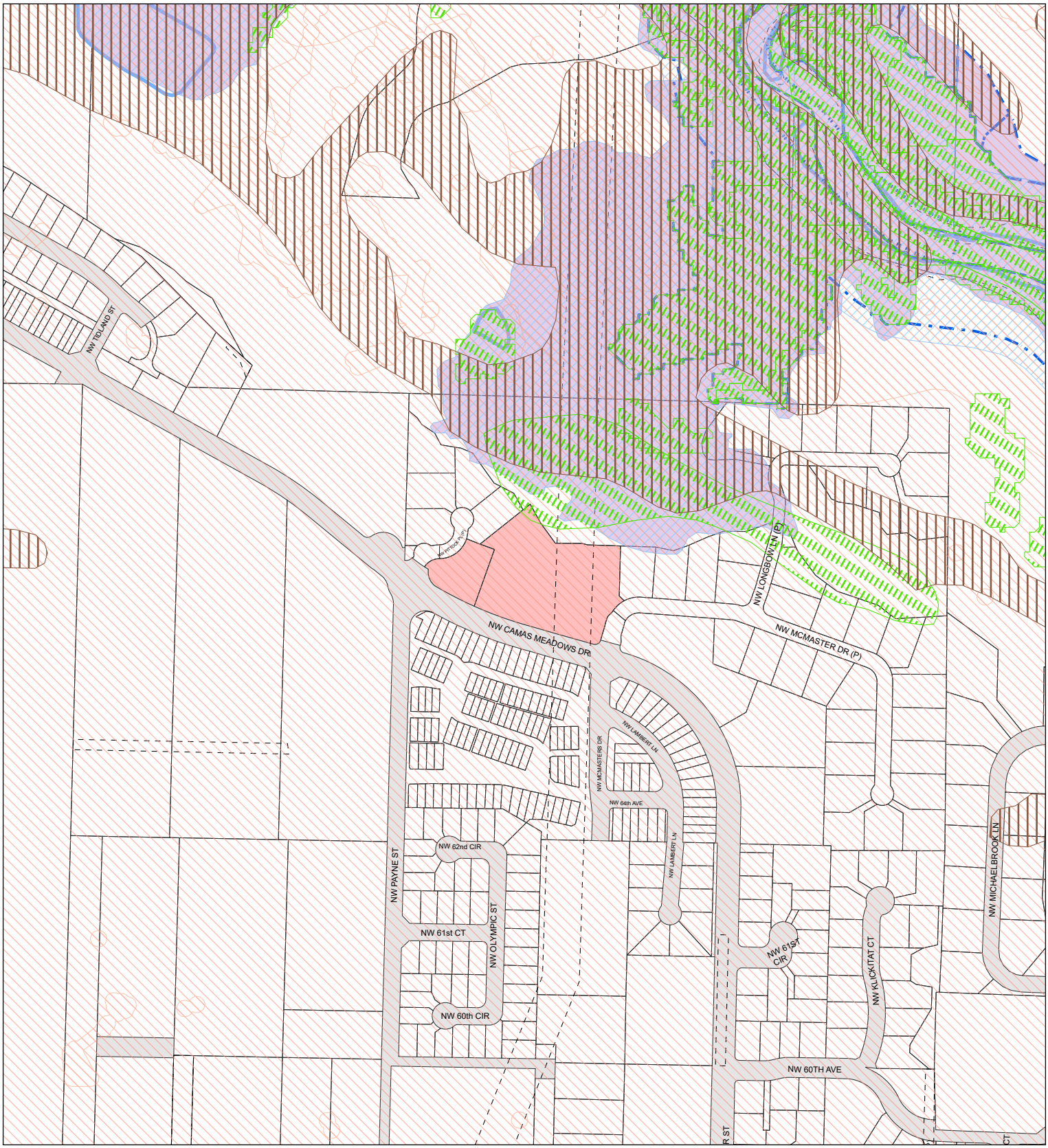
Soil Types

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Soil Type Boundary

Printed on: November 04, 2025

23120	23121	23122
23129	23128	23127
23132	23133	23134



Environmental Constraints I

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

CLARK COUNTY, WASHINGTON
Geographic Information System

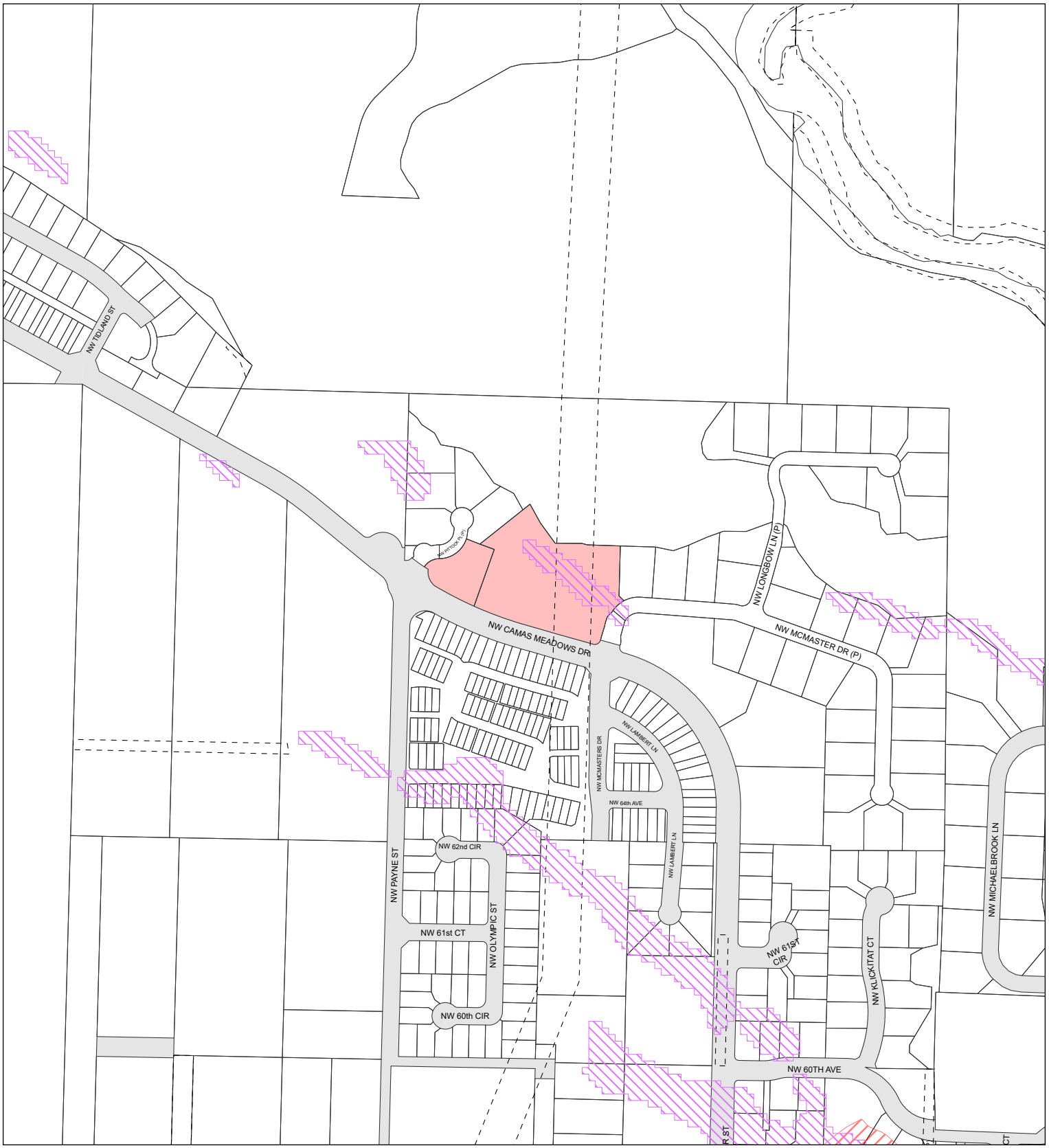
N

0 200 400 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Hydric Soils
- Wetland Inventory
- CARA Category 1
- Riparian Habitat or Species Area
- Non-Riparian Habitat or Species Area
- 100 year Floodplains
- Floodway
- Shorelines
- Stream

23120	23121	23122
23129	23128	23127
23132	23133	23134



Environmental Constraints II

Printed on: November 04, 2025

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

- Subject Property(s)
- Public Road
- Transportation or Major Utility Easement
- Slopes > 15%
- Potentially Unstable Slope
- Historic or Active Landslide
- Severe Erosion Hazard Area
- Forest Moratorium Area

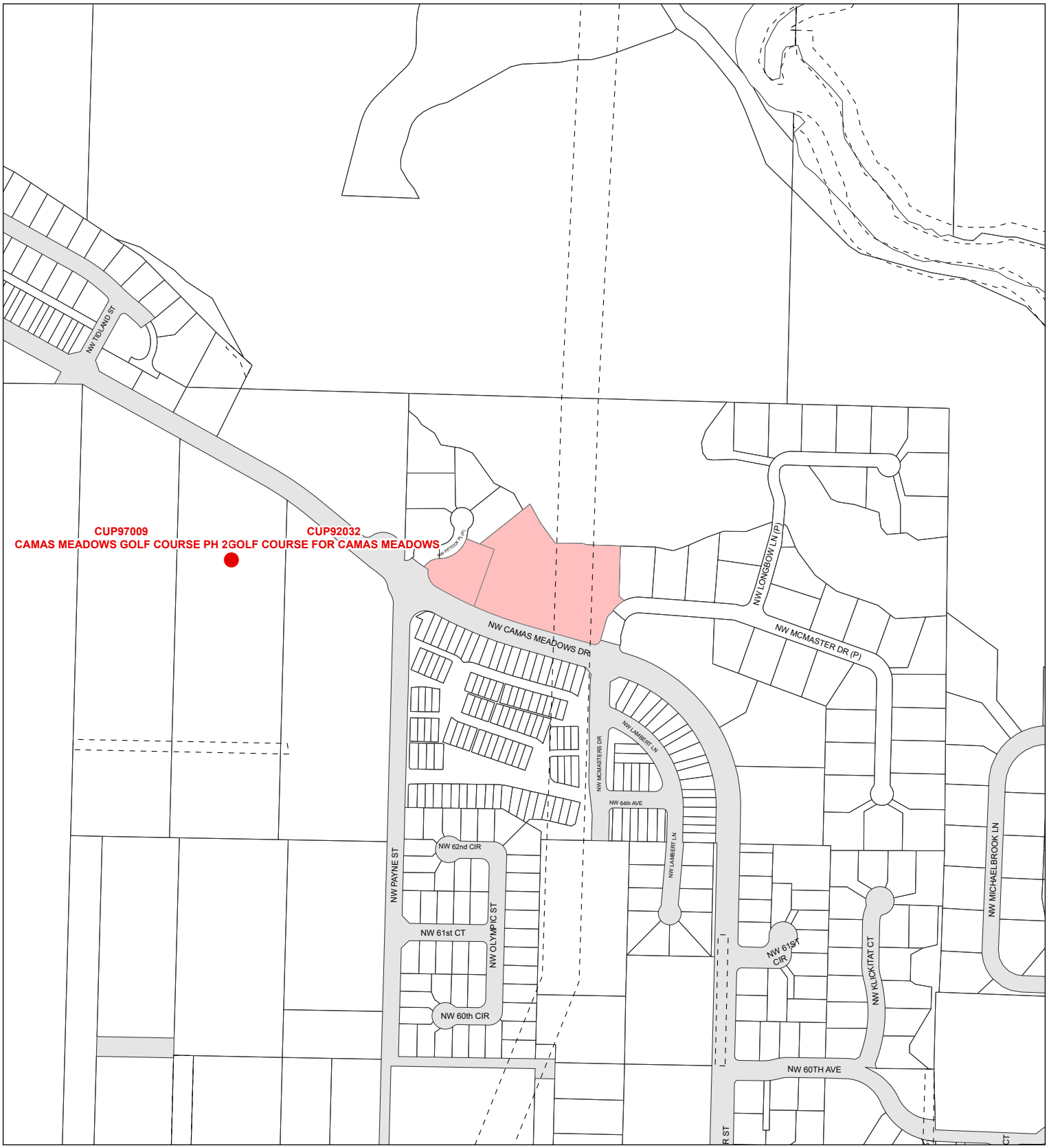
CLARK COUNTY, WASHINGTON
Geographic Information System

N

0 200 400 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

23120	23121	23122
23129	23128	23127
23132	23133	23134



CLARK COUNTY, WASHINGTON
Geographic Information System

0 200 400 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

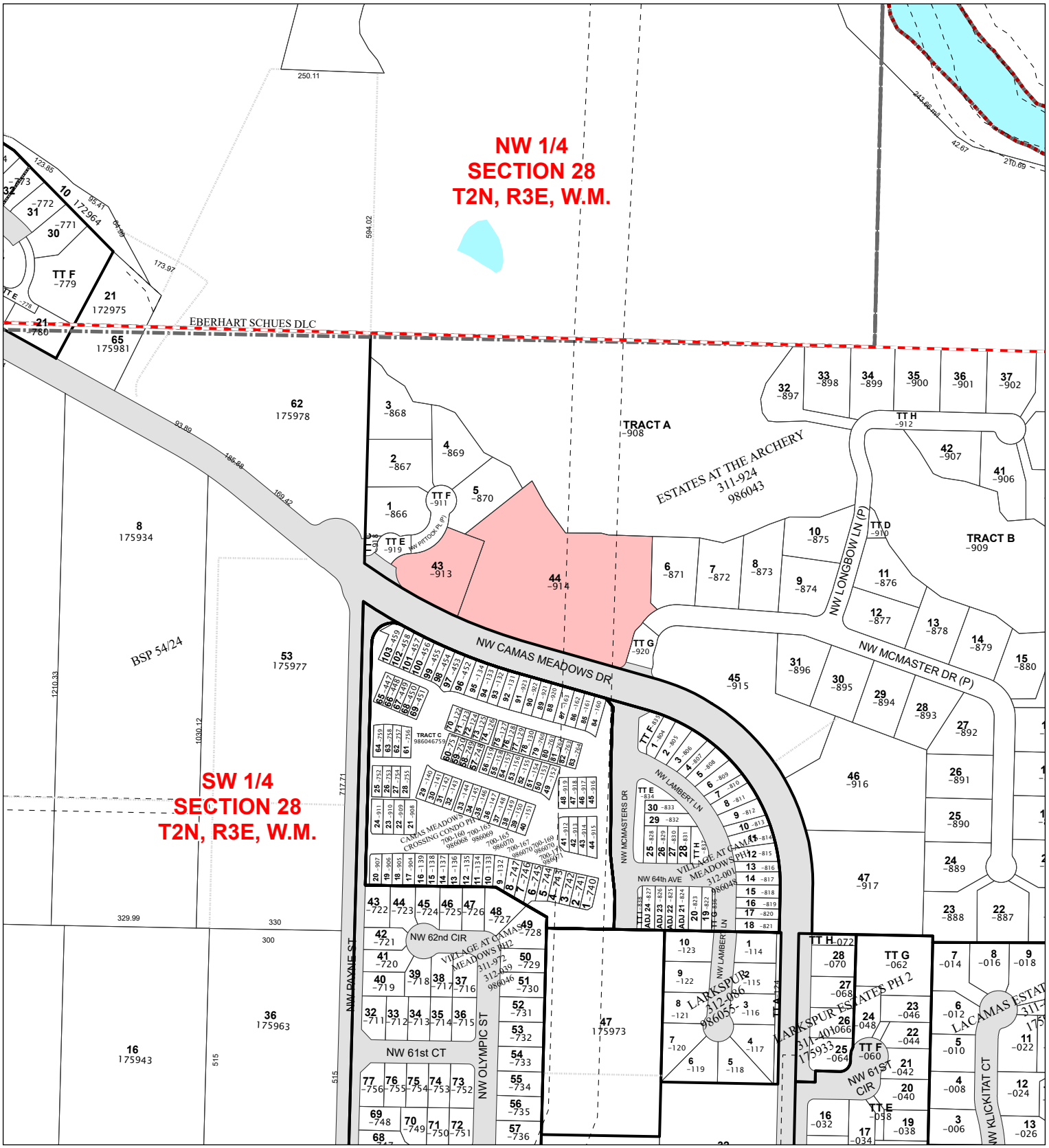
Adjacent Development

Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Subject Property(s)
Public Road
Transportation or Major Utility Easement
Adjacent Development

Printed on: November 04, 2025

23120	23121	23122
23129	23128	23127
23132	23133	23134



Quarter Section Parcels

Printed on: November 04, 2025

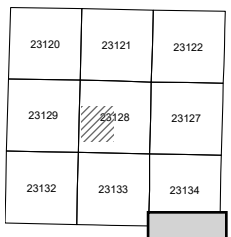
Account: 986043914, 986043913
Owner: MAS1A LLC
Address: 3405 NW MCMASTER DR
C/S/Z: CAMAS, WA 98607

Subdivision Lines
Donation Land Claim
Section Quarters
City Boundaries
Subject Property(s)
Road Right of Way - Actual Road May not Exist
Transportation or Major Utility Easement

CLARK COUNTY, WASHINGTON
Geographic Information System

0 150 300 Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.



PARKLANDS II SHORT PLAT

CAMAS, WASHINGTON (SW1/4,S28,T2N,R3E)

DEVELOPER

MAS1A LLC
ATTN: JON ELLSWORTH
3405 NW MCMASTER DRIVE
CAMAS, WASHINGTON 98607
PHONE (360) 798-2400
JONELLSWORTHRE@GMAIL.COM

GEOTECHNICAL ENGINEER

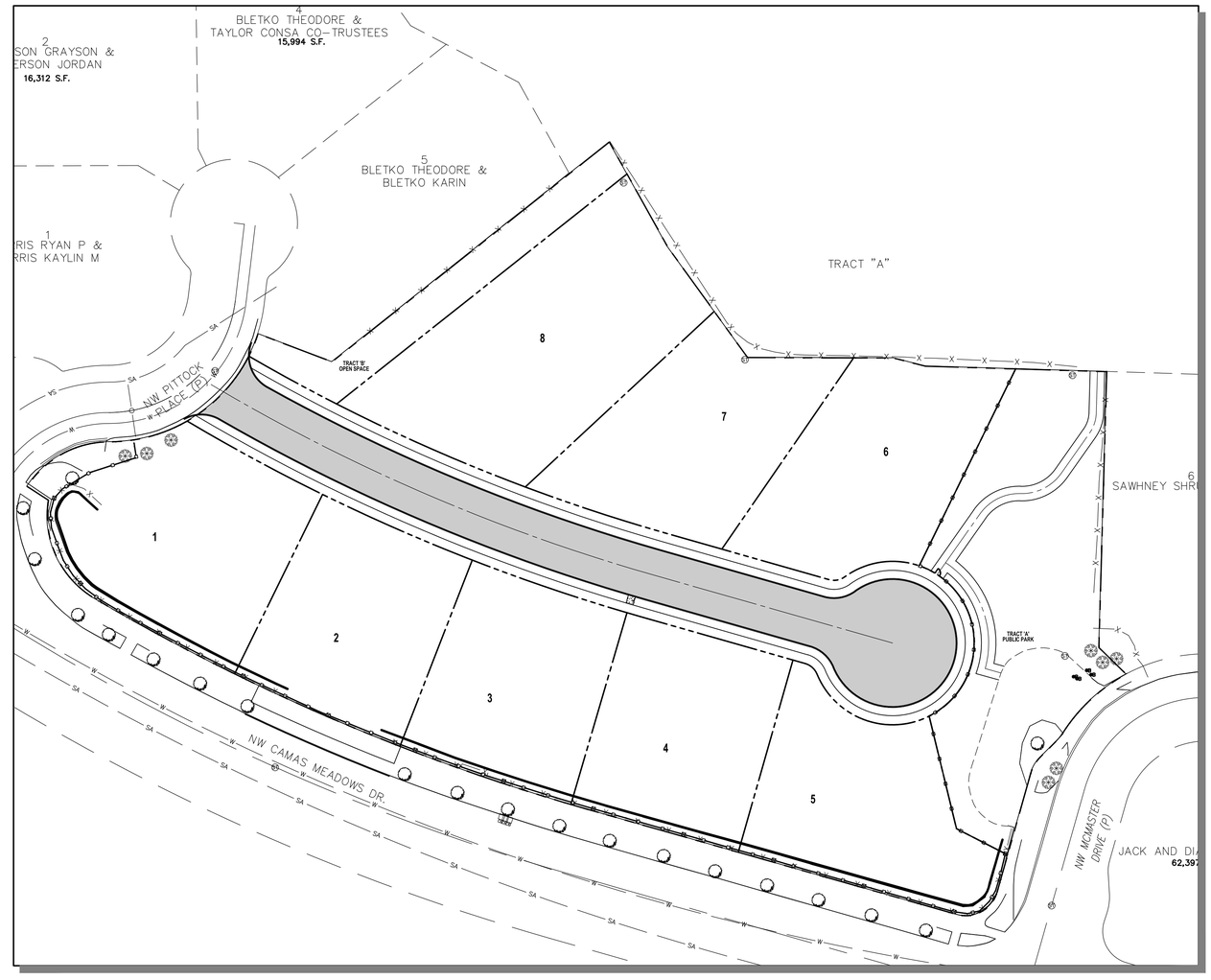
COLUMBIA WEST ENGINEERING, INC
11917 NE 95TH STREET
VANCOUVER, WASHINGTON 98682
PHONE (360) 823-2900

CONTACT

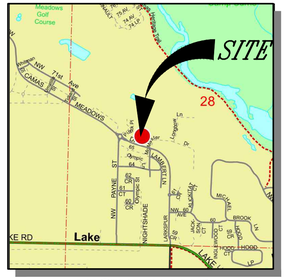
SGA ENGINEERING, PLLC
ATTN: JOE INTERMILL
2005 BROADWAY
VANCOUVER, WASHINGTON 98663
PHONE (360) 993-0911
JINTERMILL@SGAENGINEERING.COM

SURVEYOR

MINISTER-GLAESER SURVEYING, INC.
ATTN: DANIEL RENTON
2200 E. EVERGREEN BLVD
VANCOUVER, WASHINGTON 98661
PHONE (360) 694-3313
DAR@MGSSURVEY.COM



SITE MAP
SCALE: 1" = 40'



VICINITY MAP
NOT TO SCALE

LEGAL DESCRIPTION:

FOR APN/PARCEL ID(S): 986043913 AND 986043914

LOT(S) 43 AND 44, ESTATES AT THE ARCHERY, ACCORDING TO THE PLAT THEREOF, RECORDED IN VOLUME 311 OF PLATS, PAGE 924, RECORDS OF CLARK COUNTY, WASHINGTON.

LOCATED IN THE NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF THE SOUTHWEST 1/4 OF SECTION 28, TOWNSHIP 2 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN.

VERTICAL DATUM:

NAVD 88 (GEOID 2012A) BASED ON REAL TIME KINEMATIC CORRECTIONS FROM THE WASHINGTON STATE REFEREENCE NETWORK.

HORIZONTAL DATUM:

NAD 83 (2011)
WASHINGTON STATE PLAN COORDINATE SYSTEM, SOUTH ZONE, U.S. SURVEY FEET. BASED ON REAL TIME KINEMATIC CORRECTIONS FROM THE WASHINGTON STAT REFERENCE NETWORK.

SHEET INDEX

SHEET	DESCRIPTION
PRE1.0	COVER SHEET
PRE2.0	EXISTING CONDITIONS
PRE3.0	PRELIMINARY GRADING & EROSION CONTROL PLAN
PRE4.0	PRELIMINARY STREET AND STORM PLAN
PRE5.0	PRELIMINARY SANITARY & WATER PLAN
PRE5.1	PRELIMINARY SANITARY & WATER DETAILS
PRE6.0	PRELIMINARY LANDSCAPE PLAN
PRE7.0	PRELIMINARY PLAT & SITE PLAN

SGA ENGINEERING & DESIGN
CIVIL ENGINEERING ~ LAND PLANNING
DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PRELIMINARY NOT FOR CONSTRUCTION — JOE A. INTERMILL — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

COVER SHEET
PARKLANDS II SHORT PLAT
CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 40'
	7/7/2026

JOB NUMBER: 2451

SHEET: PRE1.0

© SGA ENGINEERING PLLC - DATE PLOTTED: Jul. 07, 2026 - 11:20 AM SGA DRAWING FILE: W:\DWG\2451- PARKLANDS II\DRAWINGS\2-PRELIM SHEET SET\PRE1.0 - COVER SHEET.DWG

© SGA ENGINEERING PLLC - DATE PLOTTED: Jul. 07, 2026 - 11:20 AM SGA DRAWING FILE: W:\DWG\2451 - PARKLANDS II\DRAWINGS\2-PRELIM SHEET SET\PRE2.0 - EXISTING CONDITIONS.DWG

STORM MH
RIM=199.15
IE 24"ADS SOUTHEAST=190.95
UNABLE TO ASBUILT INVERT SOUTHWEST

5
BLETKO THEODORE &
BLETKO KARIN

1
HARRIS RYAN P &
HARRIS KAYLIN M

4' METAL FENCE
3.9' NORTH OF LINE

5' METAL FENCE
ON LINE

N 51°37'17" E 194.83'

TRACT "A"

STORM MH
RIM=218.23
IE 10"ADS NORTHEAST=200.14
IE 10"ADS SOUTHEAST=200.10

S 69°09'24" E
43.43'

S 69°09'24" E
47.78'

GRAVEL

EX. STM
ESMT TO REMAIN

10' PRIVATE STORMWATER
EASEMENT PER
"ESTATES AT THE ARCHERY"
(311-924)

STORM MH
RIM=199.58
IE 24"ADS NORTHWEST=191.40
IE 24"ADS EAST=191.40

4' METAL FENCE
1.0' NORTH OF LINE

S 89°48'58" E
80.30'

S 75°34'23" E
18.07'

S 88°16'13" E 100.00'

STORM MH
RIM=196.90
IE 24"ADS WEST=191.95

100' PACIFICORP EASEMENT
AS SHOWN ON "ESTATES AT THE
(311-924)

CONC.
WALL

EX. STM
ESMT TO BE
RELOCATED

EX. LOT 43
LOT LINES TO BE
REMOVED WITH
SHORT PLAT.

NW PITTOCK
PLACE (P)

VESTCAPITAL FUND II LLC
AFN 6110842
43
23,778 S.F.

10' PRIVATE STORMWATER
EASEMENT PER "ESTATES AT THE ARCHERY"
(311-924)

10' PRIVATE STORMWATER
EASEMENT PER
"ESTATES AT THE ARCHERY"
(311-924)

S 01°37'56" W
62.89'

5' METAL FENCE
2.4' WEST OF LINE

6
SAWHNEY SHRUTI TRU

10' PUBLIC TRAIL EASEMENT
EASEMENT PER "ESTATES AT THE
(311-924)

S 01°37'46" W 89.01'

STORM MH
RIM=218.70
IE 18"ADS NORTH=199.05
IE 12"ADS NORTHEAST=199.12
IE 10"ADS WEST=199.35
IE 18"ADS SOUTH=210.30

S 19°46'51" W 182.63'

10' PRIVATE STORMWATER
EASEMENT PER "ESTATES AT THE ARCHERY"
(311-924)

3' CHAINLINK FENCE

EX. STM
ESMT TO BE
RELOCATED

VESTCAPITAL FUND II LLC
AFN 6110842
44
117,737 S.F.

STORM MH
RIM=215.63
IE 18"ADS NORTH=199.86
IE 18"ADS SOUTH=199.99
IE 12"ADS SOUTHEAST=204.8

5' METAL FENCE

CONC
BLOCK WALL

SIDEWALK

CONC
BLOCK WALL

ASPHALT

STOP

CATCH BASIN
GRATE=221.69
IE 12"ADS SOUTH=217.44

75' RIGHT OF WAY PER
AFN 5044375

3' CHAINLINK FENCE

EXISTING HYDRANT

EXISTING HYDRANT

CURBLINE

S 74°06'45" E 211.88'

N 15°48'16" E 67.93'

NW CAMAS MEADOWS DR.

NW MCMASTER
DRIVE (P)

45
JACK AND DIANE HOL
62,397 S.F.

STORM MH
RIM=222.45
IE 18"ADS NORTH=214.48
IE 18"ADS EAST=214.64
IE 18"ADS SOUTHEAST=214.74
IE 18"ADS WEST=214.70

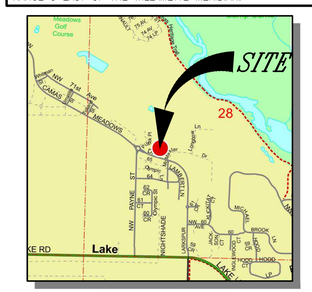
STORM MH
RIM=228.61
IE 18"ADS NORTH=220.01
IE 24"ADS SOUTH=220.08

LEGAL DESCRIPTION:

FOR APN/PARCEL ID(S): 986043913 AND 986043914

LOT(S) 43 AND 44, ESTATES AT THE ARCHERY, ACCORDING TO THE PLAT THEREOF, RECORDED IN VOLUME 311 OF PLATS, PAGE 924, RECORDS OF CLARK COUNTY, WASHINGTON.

LOCATED IN THE NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF THE SOUTHWEST 1/4 OF SECTION 28, TOWNSHIP 2 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN.



VICINITY MAP
NOT TO SCALE

0 30 60 90
Scale: 1" = 30'

PARKLANDS II

PRELIMINARY APPLICATION

MARCH 2026

APPLICANT INFORMATION	OWNER INFORMATION
MAS1A, LLC ATTN: JON ELLSWORTH 3405 NW MCMASTER DRIVE CAMAS, WA 98607 (360) 798 - 2400 JONELLSWORTH@GMAIL.COM	SAME AS APPLICANT

APPLICANT REPRESENTATIVE INFORMATION

SGA ENGINEERING, PLLC
ATTN: SCOTT TAYLOR & NATE HORVATH
2005 BROADWAY STREET
VANCOUVER, WA 98663
(360) 993 - 0911
STAYLOR@SGAENGINEERING.COM / NHORVATH@SGAENGINEERING.COM

EXISTING SITE INFORMATION

BEING A PORTION OF THE SOUTHWEST QUARTER OF SECTION 28, TOWNSHIP 2 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN.

PARCEL NUMBER	986043913 & 986043914	
PARCEL ADDRESS	3815 & 3711 NW CAMAS MEADOWS DRIVE CAMAS, WASHINGTON 98607	
EXISTING USE	VACANT	
ZONING DESIGNATION	BUSINESS PARK (BP) & R1-15	
GROSS SITE AREA	3.25 AC	141,521 SF
TRANSIT ROUTES	NO TRANSIT ROUTES ARE NEAR THE PROJECT SITE	

EXISTING UTILITIES

SEWER	CITY OF CAMAS
WATER	CITY OF CAMAS

ENVIRONMENTAL CONDITIONS

THE PROJECT SITE HAD A SEPA DETERMINATION OF NONSIGNIFICANCE ON JAN. 12TH, 2016. NO FURTHER DETERMINATION NEEDED FOR THIS PROJECT APPLICATION.

EXISTING CONDITIONS DISCLAIMER

THE EXISTING CONDITIONS SHOWN ON THIS PLAN WERE OBTAINED FROM INFORMATION PROVIDED BY MGS SURVEYING. SGA ENGINEERING, PLLC DOES NOT GUARANTEE THE ACCURACY OF THIS INFORMATION.

SGA ENGINEERING & DESIGN
CIVIL ENGINEERING ~ LAND PLANNING
DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PRELIMINARY
NOT FOR CONSTRUCTION

EXISTING CONDITIONS

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

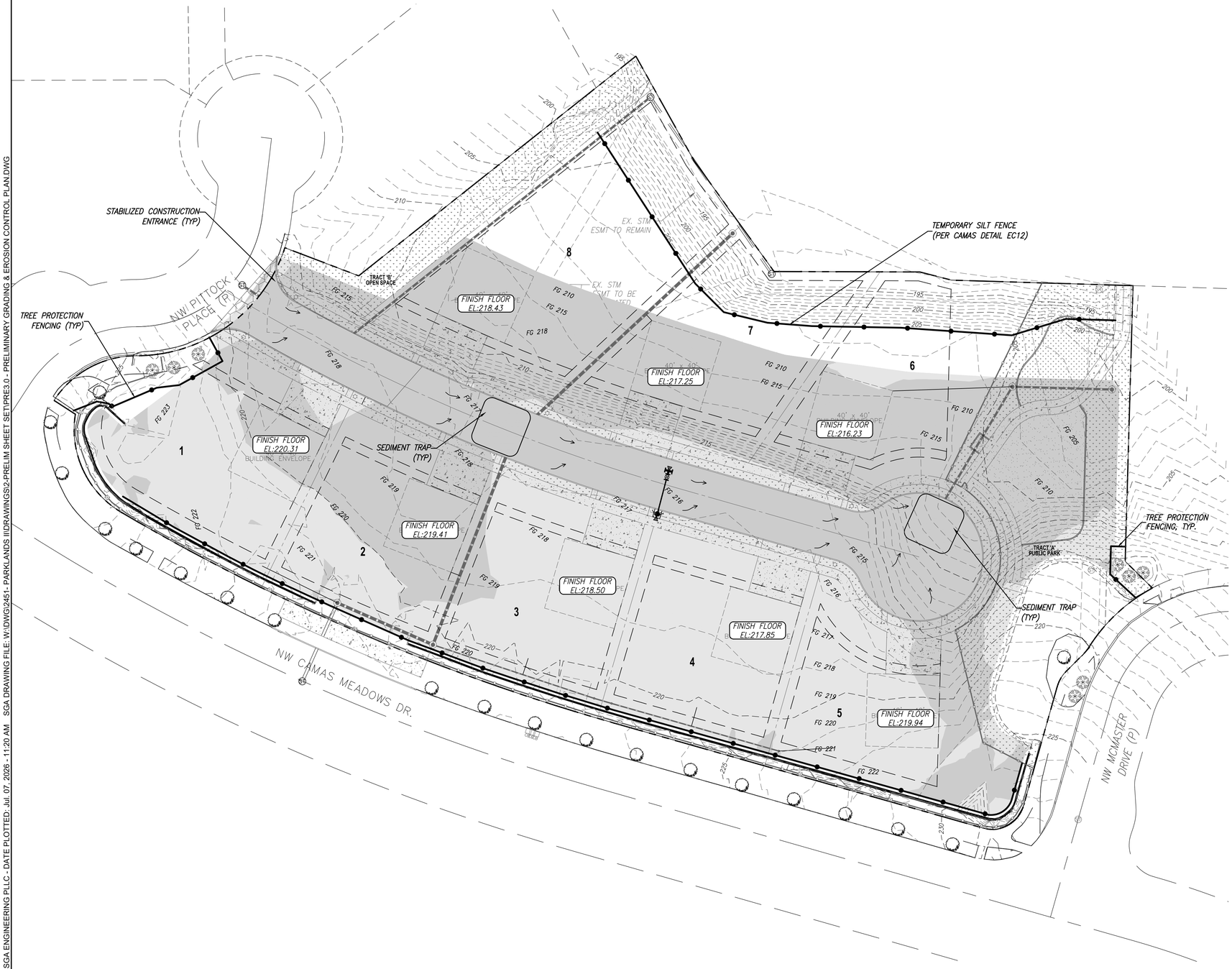
PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 30'
	7/7/2026

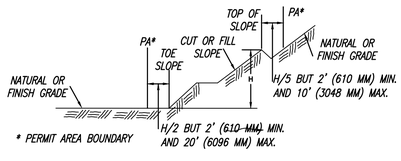
JOB NUMBER: 2451

SHEET: PRE2.0



LEGEND

- FILL AREA
- CUT AREA
- FG 100 — FINISHED GRADE CONTOURS
- 100 — EXISTING MAJOR CONTOURS
- TREES TO BE REMOVED
- STABILIZED CONSTRUCTION ENTRANCE (PER DETAIL EC6)
- TEMPORARY SEDIMENTATION TRAP (PER DETAIL E22)
- TEMPORARY SILT FENCE (PER DETAIL EC12)
- TEMPORARY STRAW WADDLES (PER DETAIL EC14)
- FLOW ARROW



NOTE: GRADING ACTIVITIES MUST BE AT LEAST TWO (2) FEET AWAY FROM PROPERTY BOUNDARIES

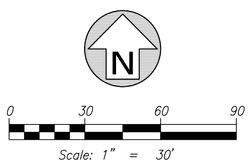
IBC APPENDIX J GRADING DETAIL

NO SCALE

DIRT QUANTITIES (CY)		
ITEM	CUT	FILL
SITE GRADING	1,500	6,700
TRENCH SPOILS	TBD	---
IMPORT	5,200	---
TOTAL	6,700	6,700

1. ASSUMED 1.00' FOR SITE STRIPPINGS PER GEOTECH RECOMMENDATIONS ACTUAL CONDITIONS MAY VARY AND WILL EFFECT THE STRIPPING VOLUME.
2. EXCESS TRENCH SPOILS WILL BE STOCKPILED PRIOR TO BEING HAULED OFF SITE OR MAY BE USED AS STRUCTURAL FILL.
3. STRIPPINGS WILL BE STOCKPILED PRIOR TO BEING HAULED OFF SITE OR MAY BE USED NON-STRUCTURAL FILL.

QUANTITIES DO NOT ACCOUNT FOR SHRINK AND SWELL FACTORS. ACTUAL MATERIAL QUANTITIES MAY VARY PER SOIL TYPE, SOIL CONDITIONS, & CONSTRUCTION PRACTICES.



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FAX (360)993-0912

PRELIMINARY GRADING & EROSION CONTROL PLAN

PARKLANDS II SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

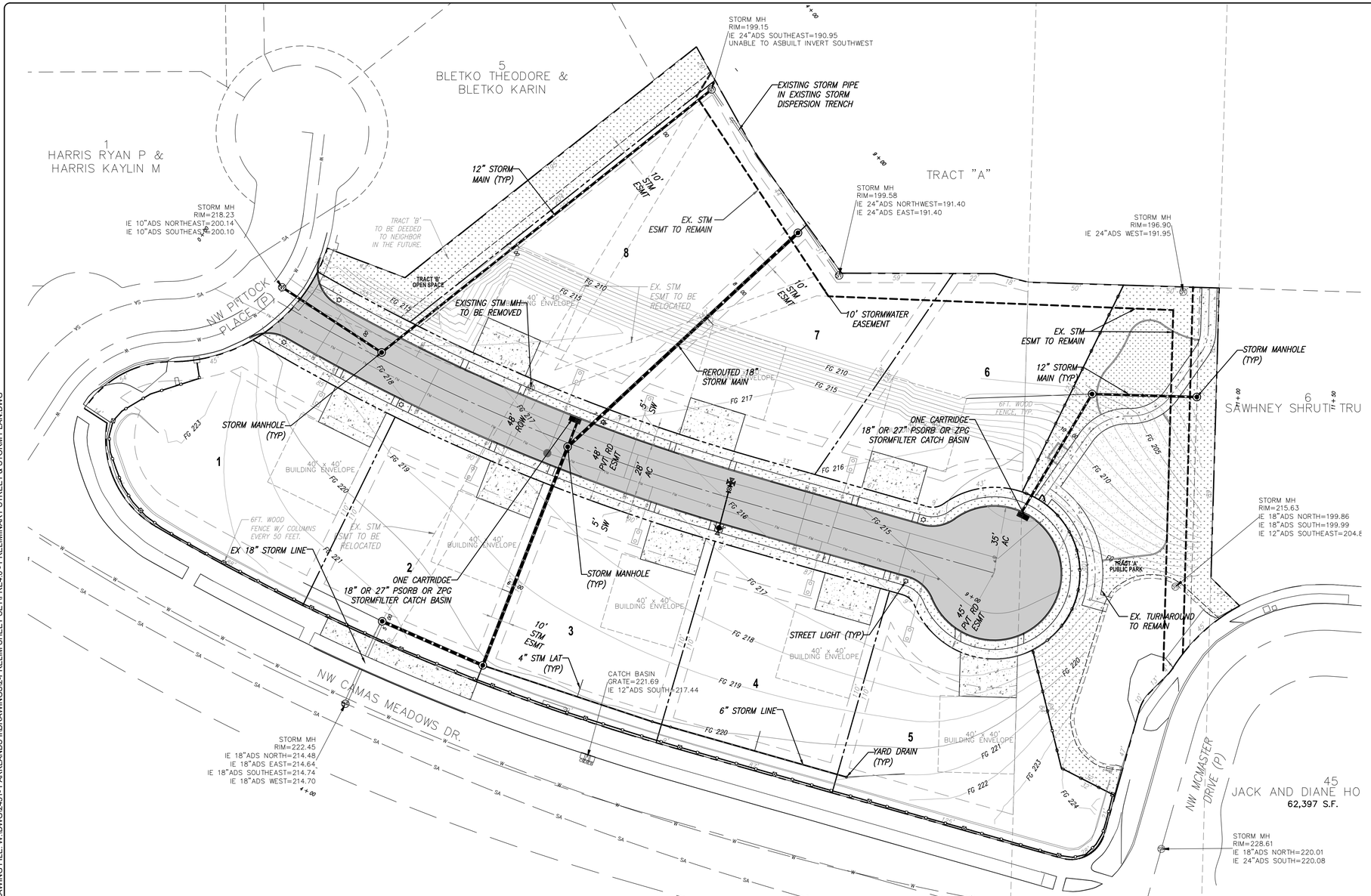
REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 30'
	7/7/2026

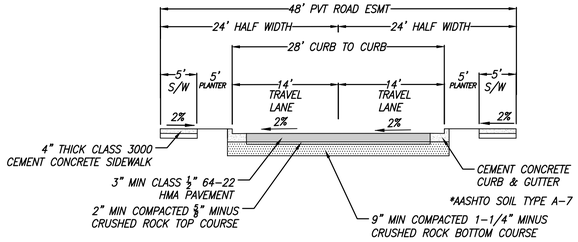
JOB NUMBER: 2451

SHEET: PRE3.0

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- STREET LIGHTING SPACING DESIGNED IN ACCORDANCE WITH CITY OF CAMAS AND CLARK PUD STANDARDS (~250'–350' TYPICAL SPACING)



PRIVATE ROAD (PRIVATE)

PRIVATE STREET – D
NO SCALE

N

0 30 60 90

Scale: 1" = 30'

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LANDSCAPE ARCHITECTURE
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VANCOUVER, WA 98663
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FAX (360)993-0912

PRELIMINARY NOT FOR CONSTRUCTION
JOSE A. INTRIAGO
STATE OF WASHINGTON
PROFESSIONAL ENGINEER

PRELIMINARY STREET & STORM PLAN

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

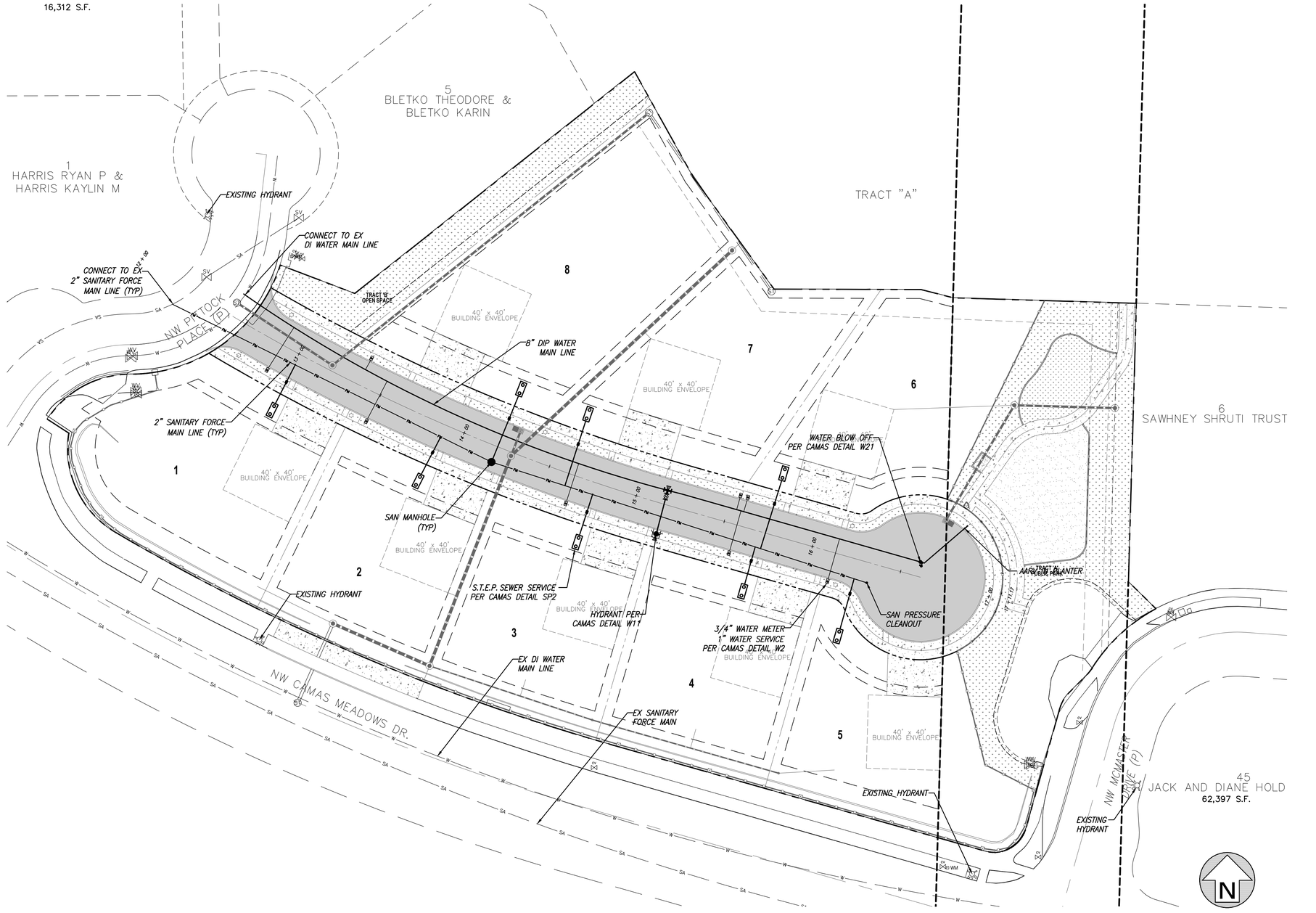
REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 30'
	7/7/2026

JOB NUMBER: 2451

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DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

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STATE OF WASHINGTON
JAMES A. IRVINE
EXPIRES 10/10/2026
REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY SANITARY & WATER PLAN

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

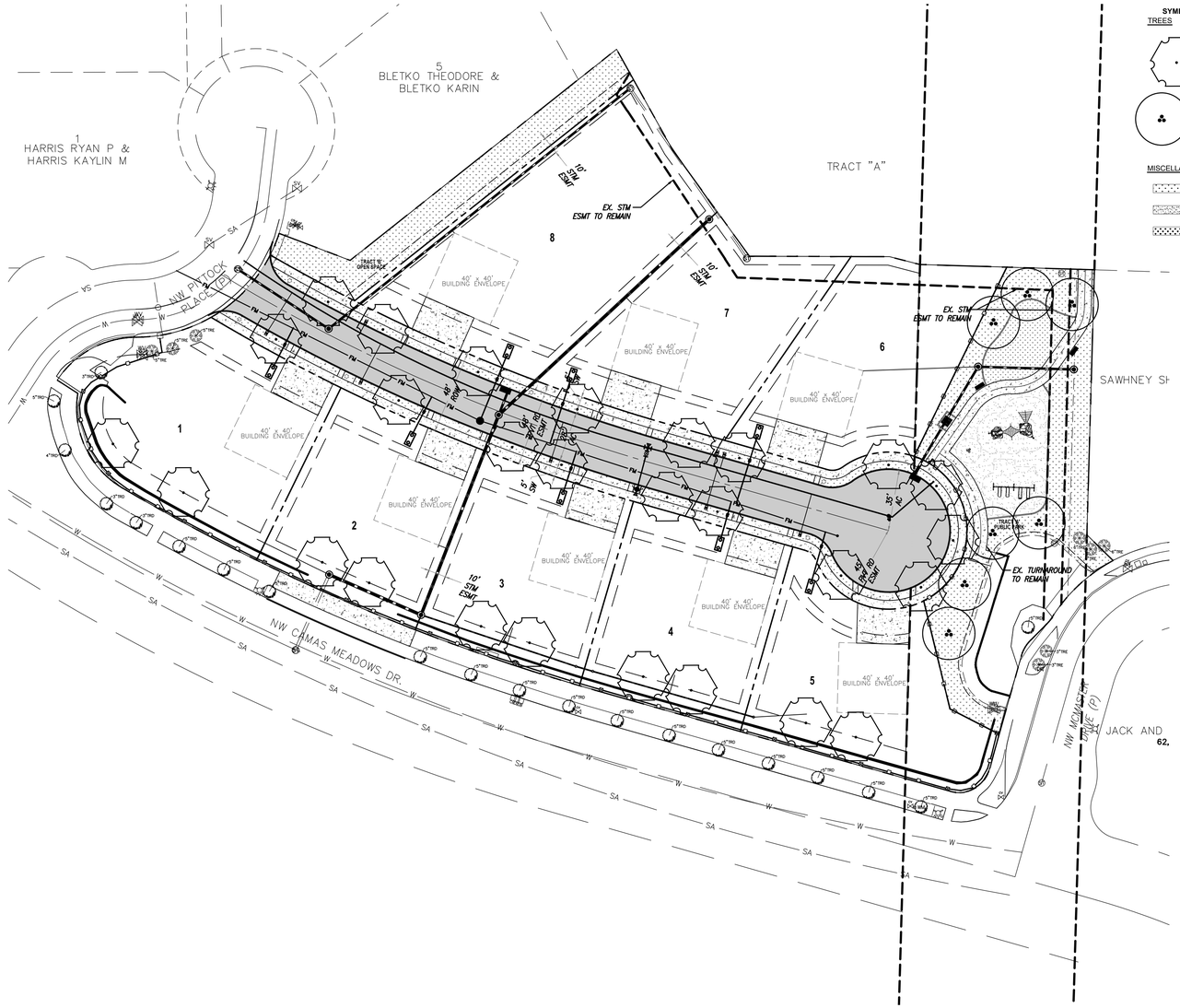
REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	1" = 30'
	7/7/2026

JOB NUMBER: 2451

SHEET: PRE5.0

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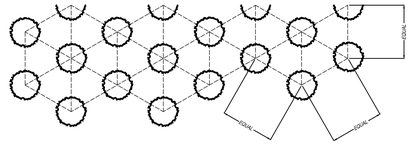
PLANT LEGEND

SYMBOL	PLANT NAME (SCIENTIFIC)	PLANT NAME (COMMON)	SIZE	SPACING	QUANTITY
TREES					
	Acer rubrum 'Autumn Flame'	Autumn Flame Maple	2" cal.	30' O.C.	27
	Zelkova serrata 'Green Vase'	Green Vase Zelkova	2" cal.	AS SHOWN	7

MISCELLANEOUS	
LANDSCAPE AREA: WOOD MULCH, ROCK, TURF GRASS	15,385 SF
PLAYGROUND SURFACE AREA: ENGINEERED WOOD FIBER	3,013 SF
PLAYGROUND TURF AREA: TURF GRASS	1,493 SF

General Landscape Notes

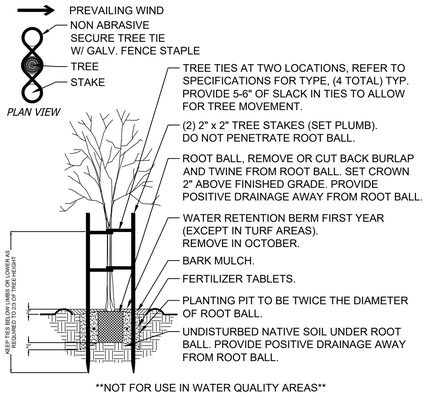
1. Landscaping shall be watered with an irrigation system capable of sustaining all plantings in a healthy condition year-round.
2. Trees and other plantings shall be watered, pruned, fertilized, and maintained in a healthy condition.
3. Existing trees shall be protected from damage during and following construction.
4. Trees in the public right-of-way shall be installed by the developer or builder prior to issuance of the occupancy permit for the adjacent lot.
5. Trees on individual lots shall be installed by the developer or builder prior to issuance of the occupancy permit for that lot. Trees should not be installed until after driveways, sidewalks, and heavy construction activities are completed.
6. Approximate tree locations are shown on the plan; exact locations shall be determined by the developer or builder after construction of driveways, sidewalks, and buildings.
7. Long-term pruning and maintenance shall be performed by individual homeowners or the homeowner's association.
8. The contractor or builder shall be responsible for meeting soil quality and depth requirements (BMP T5.13) for all disturbed areas.
9. Proposed plant species may be substituted with equivalent species of similar size, form, and performance characteristics when approved by the landscape architect or reviewing authority.
10. Minimum plant sizes at installation shall be as follows:
    - Deciduous shade trees: minimum 2-inch caliper.
    - Evergreen trees: minimum 6-foot height.
    - Ornamental trees: minimum 1.5-inch caliper.
    - Shrubs: minimum 2-gallon container size.
    - Groundcovers/perennials: minimum 4-inch pots, spaced per plan.
11. All plant material installed by the developer or builder shall be warranted to remain alive and in healthy condition for a minimum period of one (1) year from the date of installation. Dead or declining plant material shall be replaced in kind.



NOTES:
- All ground cover shall be planted at equal triangular spacing as specified in Planting Legend.
- Ground cover to be located one half of specified spacing distance from any hard surface, unless otherwise specified.
- Refer to all plan sheet specifications before bidding and constructing.

Typical Shrub Spacing

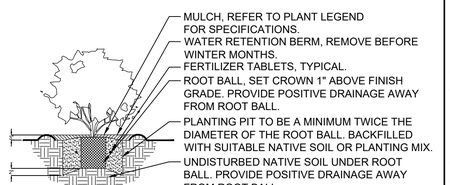
NTS



NOT FOR USE IN WATER QUALITY AREAS

Typical Tree Planting

NTS



Typical Shrub Planting

NTS

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DEVELOPMENT SERVICES
LANDSCAPE ARCHITECTURE
2005 BROADWAY
VANCOUVER, WA 98663
PHONE (360)993-0911
FAX (360)993-0912

PRELIMINARY NOT FOR CONSTRUCTION

STATE OF WASHINGTON
LICENSED
LANDSCAPE ARCHITECT
SCOTT A. TAYLOR
LICENSE NO. 1247
EXPIRES ON _____

PRELIMINARY LANDSCAPE PLAN

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

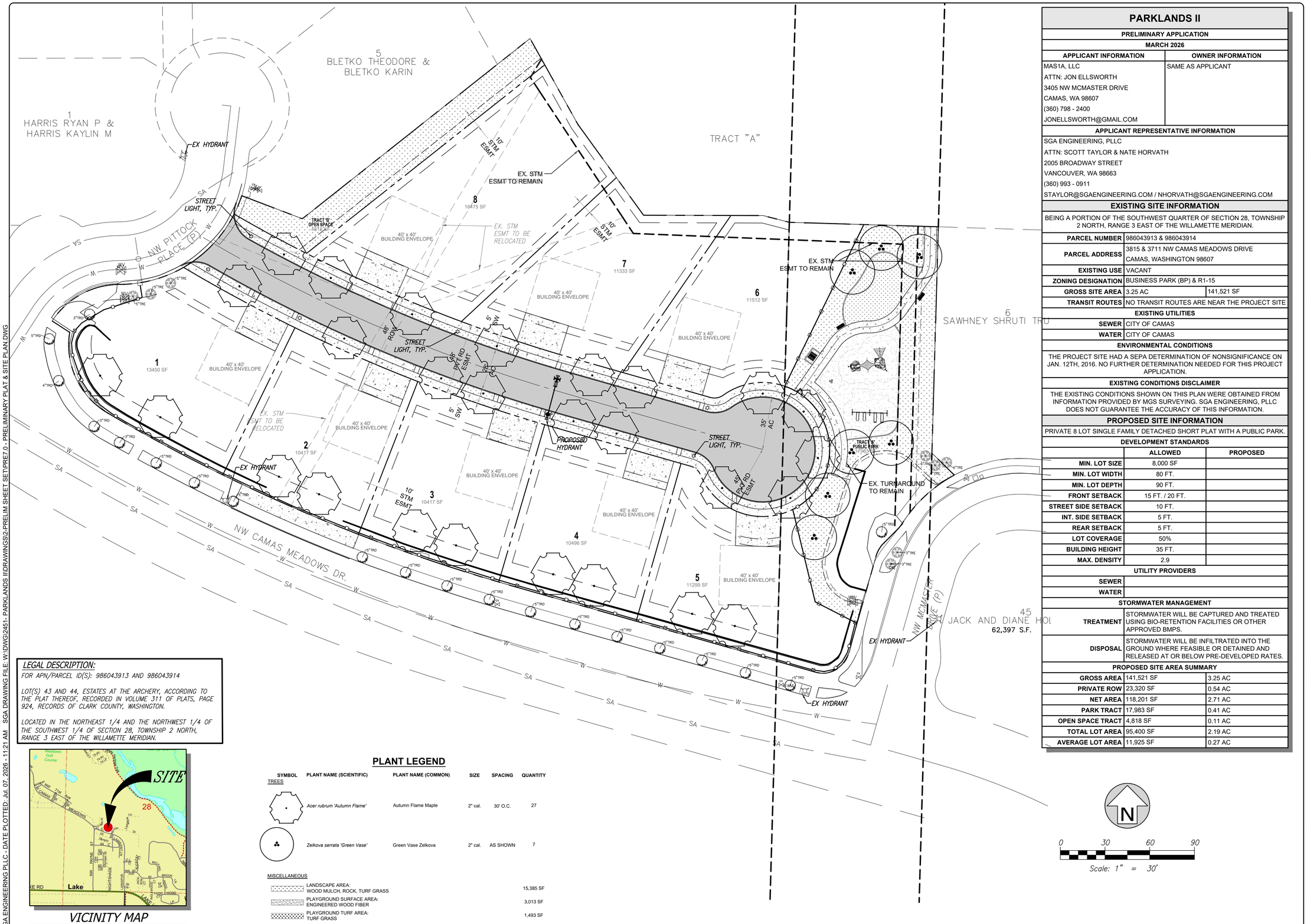
REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
CHECKED BY:	JAI
SCALE:	#########
DATE:	7/7/2026

JOB NUMBER: 2451

SHEET: PRE6.0

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PARKLANDS II

PRELIMINARY APPLICATION

MARCH 2026

APPLICANT INFORMATION	OWNER INFORMATION
MAS1A, LLC ATTN: JON ELLSWORTH 3405 NW MCMASTER DRIVE CAMAS, WA 98607 (360) 798 - 2400 JONELLSWORTH@GMAIL.COM	SAME AS APPLICANT

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EXISTING USE	VACANT	
ZONING DESIGNATION	BUSINESS PARK (BP) & R1-15	
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TRANSIT ROUTES	NO TRANSIT ROUTES ARE NEAR THE PROJECT SITE	

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WATER	CITY OF CAMAS

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PROPOSED SITE INFORMATION

PRIVATE 8 LOT SINGLE FAMILY DETACHED SHORT PLAT WITH A PUBLIC PARK.

DEVELOPMENT STANDARDS

	ALLOWED	PROPOSED
MIN. LOT SIZE	8,000 SF	
MIN. LOT WIDTH	80 FT.	
MIN. LOT DEPTH	90 FT.	
FRONT SETBACK	15 FT. / 20 FT.	
STREET SIDE SETBACK	10 FT.	
INT. SIDE SETBACK	5 FT.	
REAR SETBACK	5 FT.	
LOT COVERAGE	50%	
BUILDING HEIGHT	35 FT.	
MAX. DENSITY	2.9	

UTILITY PROVIDERS

SEWER	
WATER	

STORMWATER MANAGEMENT

TREATMENT	STORMWATER WILL BE CAPTURED AND TREATED USING BIO-RETENTION FACILITIES OR OTHER APPROVED BMPS.
DISPOSAL	STORMWATER WILL BE INFILTRATED INTO THE GROUND WHERE FEASIBLE OR DETAINED AND RELEASED AT OR BELOW PRE-DEVELOPED RATES.

PROPOSED SITE AREA SUMMARY

GROSS AREA	141,521 SF	3.25 AC
PRIVATE ROW	23,320 SF	0.54 AC
NET AREA	118,201 SF	2.71 AC
PARK TRACT	17,983 SF	0.41 AC
OPEN SPACE TRACT	4,818 SF	0.11 AC
TOTAL LOT AREA	95,400 SF	2.19 AC
AVERAGE LOT AREA	11,925 SF	0.27 AC

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PHONE (360)993-0911
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PRELIMINARY PLAT & SITE PLAN

PARKLANDS II
SHORT PLAT

CITY OF CAMAS WASHINGTON

PRELIMINARY

REVISIONS

DESIGNED BY:	NDM
DRAWN BY:	NDM
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SCALE:	#########
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SHEET: PRE7.0

LEGAL DESCRIPTION:

FOR APN/PARCEL ID(S): 986043913 AND 986043914

LOT(S) 43 AND 44, ESTATES AT THE ARCHERY, ACCORDING TO THE PLAT THEREOF, RECORDED IN VOLUME 311 OF PLATS, PAGE 924, RECORDS OF CLARK COUNTY, WASHINGTON.

LOCATED IN THE NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF THE SOUTHWEST 1/4 OF SECTION 28, TOWNSHIP 2 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN.

VICINITY MAP
NOT TO SCALE

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Scale: 1" = 30'

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In re: Parklands II Short Plat

) NO. SP26-1005
)
) AFFIDAVIT OF MAILING
)
)
)
)
)
Respondent.)

STATE OF WASHINGTON)
) ss.
CLARK COUNTY)

I, Carey Certo, on oath says:

I, Carey Certo, on August 5, 2026, I directed a true and correct copy of the Notice of Application be served upon the parties herein, in the above-entitled action, by depositing with the U.S. Post Office, Camas, Washington, a postage-prepaid envelope containing same addressed as follows: See attached list.

Carey Certo
SIGNATURE

SUBSCRIBED and SWORN to before me this 6th day of August, 2026.

Aireanna Baldwin
Notary Public
State of Washington
My Appointment Expires 10/1/2028
Commission Number 183848

Aireanna Baldwin
Notary Public in and for the State of Washington, residing at Clark County
My appointment expires: 10/1/2028

Cm #567 LLC
915 W 11th St
Vancouver WA 98660

County Properties East LLC
4857 NW Lake Rd #320
Camas WA 98607

Ryan Harris
6613 NW Pittock Pl
Camas WA 98607

Grayson Anderson
6619 NW Pittock Pl
Camas WA 98607

Jennifer Ramsay
6625 NW Pittock Pl
Camas WA 98607

Bletko Theodore & Taylor Consa Co-Trustees
C/O Michael Bletko & Marlene Bletko
Scottsdale AZ 85262

Theodore Bletko
6618 NW Pittock Pl
Camas WA 98607

Shruti Sawhney
620 SE 168th Ave Apt V90
Vancouver WA 98684

Jorge Castro
3623 NW McMaster Dr
Camas WA 98607

Tod McClaskey Jr
19919 SE Ascension Loop
Camas WA 98607

PO-Chieh Cheng
3611 NW McMaster Dr
Camas WA 98607

Craig Anderson
6515 NW Longbow Ln
Camas WA 98607

Betty Peng
3530 NW McMaster Dr
Camas WA 98607

The Parklands At Camas Meadows Residential Hoa
4225 NE Saint James Rd
Vancouver WA 98663

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Vancouver WA 98663

Jack & Diane Holdings LLC
PO Box 452
Camas WA 98607

Archery At Camas Meadows Owners Assoc
PO Box 61962
Vancouver WA 98666

Archery At Camas Meadows Owners Assoc
PO Box 61962
Vancouver WA 98666

Archery At Camas Meadows Owners Assoc
PO Box 61962
Vancouver WA 98666

Hunt Camas Land LLC
8815 122nd Ave NE Ste 200
Kirkland WA 98033

Victor Lagoa
6524 NW Lambert Ln
Camas WA 98607

Douglas Burckhard
5789 NW Hood Lp
Camas WA 98607

Adele Homsher
6510 NW Lambert Ln
Camas WA 98607

Stephen Liss
6504 NW Lambert Lane
Camas WA 98607

Mark Skolnick
6458 NW Lambert Ln
Camas WA 90730

Village At Camas Meadows Hoa
701 Columbia St Ste111
Vancouver WA 98660

Village At Camas Meadows Hoa
701 Columbia St Ste111
Vancouver WA 98660

Neal Erickson
6416 NW Olympic Ln #45
Camas WA 98607

Toll Bros Inc
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Lake Oswego OR 97035

Toll Bros Inc
1 Centerpointe Dr #550
Lake Oswego OR 97035

Alexandra Sosa
20427 NE 64th Pl
Redmond WA 98053

Toll Bros Inc
1 Centerpointe Dr #550
Lake Oswego OR 97035

Toll Bros Inc
1 Centerpointe Dr #550
Lake Oswego OR 97035

Toll Bros Inc
1 Centerpointe Dr #550
Lake Oswego OR 97035

Pradnya Khalate
3877 NW 65th Ave Unit 91
Camas WA 98607

Toll Bros Inc
1 Centerpointe Dr Ste 550
Lake Oswego OR 97035

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Parklands II Short Plat and Plat Alteration
(File No. SP26-1005 & PLATALT26-1001)

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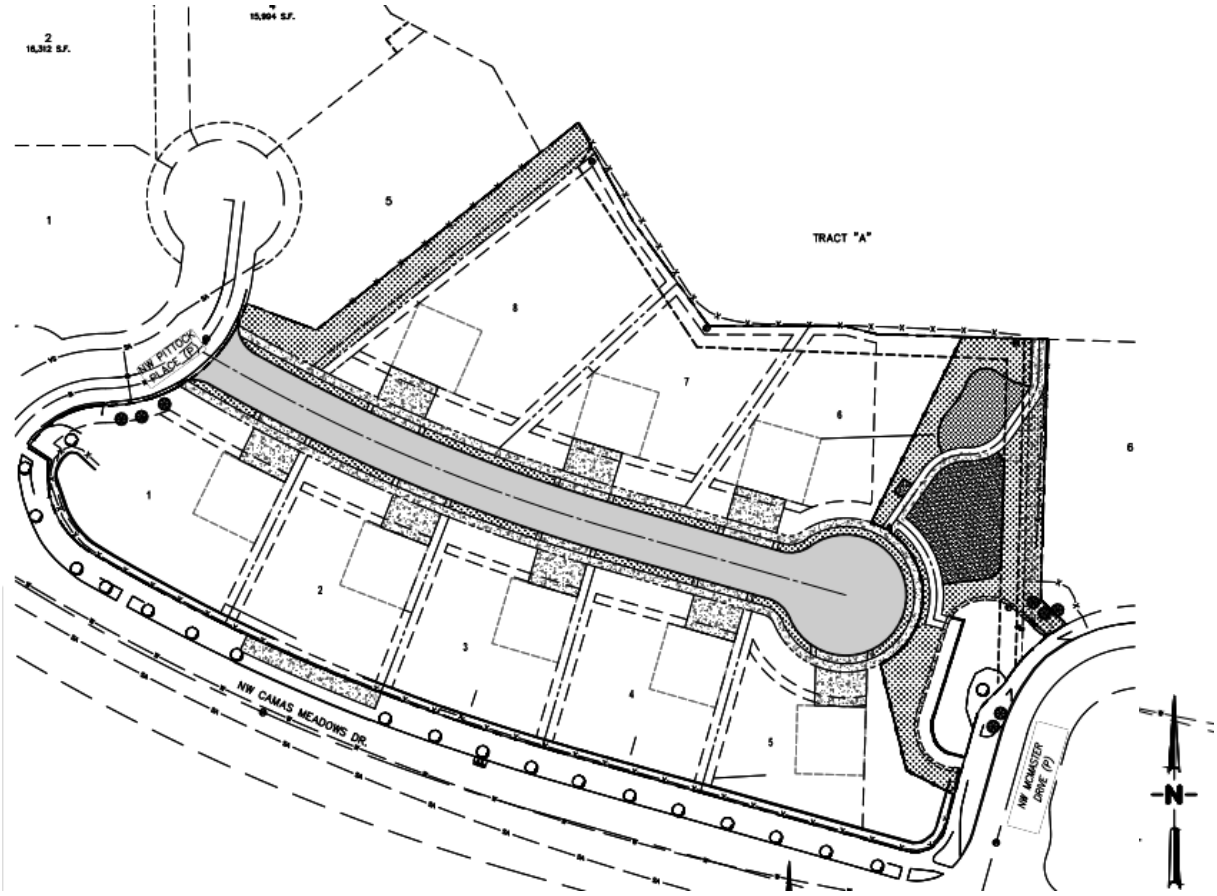
Questions/Comments: For questions related to this application, please contact Lauren Hollenbeck, Senior Planner, at (360) 817-7253 or by email at communitydevelopment@cityofcamas.us.

Published in the Post Record on August 6, 2026 Legal Publication #1119130
Posted at Camas City Hall, Camas Library, City of Camas website at: http://www.cityofcamas.us
Mailed to property owners within 300-feet on August 5, 2026

VICINITY MAP



CONCEPTUAL SITE PLAN



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(File No. SP26-1005 & PLATALT26-1001)

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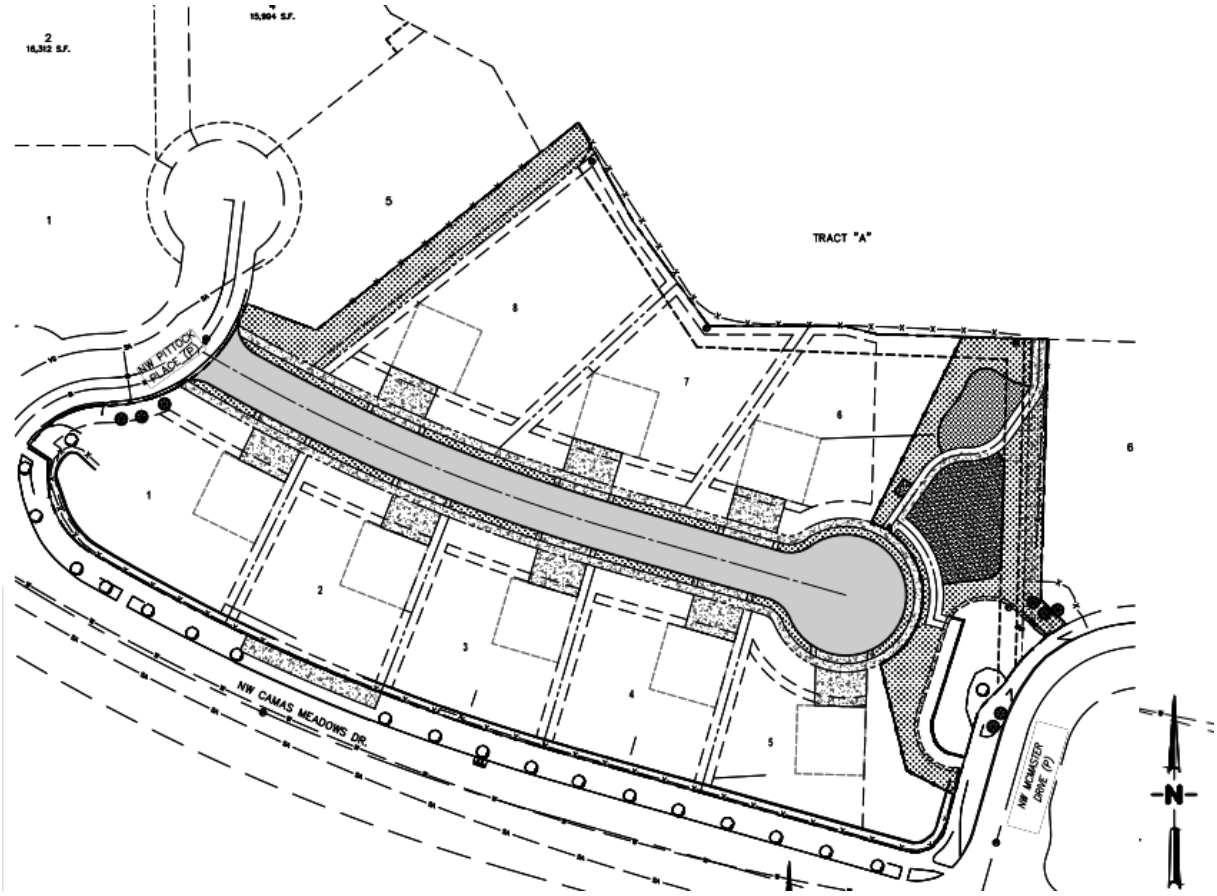
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VICINITY MAP



CONCEPTUAL SITE PLAN



In re: Parklands II Short Plat

) NO. SP26-1005
)
) AFFIDAVIT OF MAILING
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)
)
)
)
Respondent.)

STATE OF WASHINGTON)
) ss.
CLARK COUNTY)

I, Carey Certo, on oath says:

I, Carey Certo, on October 21, 2026, I directed a true and correct copy of the Notice of Public Hearing be served upon the parties herein, in the above-entitled action, by depositing with the U.S. Post Office, Camas, Washington, a postage-prepaid envelope containing same addressed as follows: See attached list.

Carey Certo
SIGNATURE

SUBSCRIBED and SWORN to before me this 22nd day of October, 2026.

Alreanna Baldwin
Notary Public
State of Washington
My Appointment Expires 10/1/2028
Commission Number 183848

Alreanna Baldwin
Notary Public in and for the State of Washington, residing at Clark County
My appointment expires: 10/1/2028

Cm #567 LLC
915 W 11th St
Vancouver WA 98660

County Properties East LLC
4857 NW Lake Rd #320
Camas WA 98607

Ryan Harris
6613 NW Pittock Pl
Camas WA 98607

Grayson Anderson
6619 NW Pittock Pl
Camas WA 98607

Jennifer Ramsay
6625 NW Pittock Pl
Camas WA 98607

Bletko Theodore & Taylor Consa Co-Trustees
C/O Michael Bletko & Marlene Bletko
Scottsdale AZ 85262

Theodore Bletko
6618 NW Pittock Pl
Camas WA 98607

Shruti Sawhney
620 SE 168th Ave Apt V90
Vancouver WA 98684

Jorge Castro
3623 NW McMaster Dr
Camas WA 98607

Tod McClaskey Jr
19919 SE Ascension Loop
Camas WA 98607

PO-Chieh Cheng
3611 NW McMaster Dr
Camas WA 98607

Craig Anderson
6515 NW Longbow Ln
Camas WA 98607

Betty Peng
3530 NW McMaster Dr
Camas WA 98607

The Parklands At Camas Meadows Residential Hoa
4225 NE Saint James Rd
Vancouver WA 98663

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Vancouver WA 98663

Jack & Diane Holdings LLC
PO Box 452
Camas WA 98607

Archery At Camas Meadows Owners Assoc
PO Box 61962
Vancouver WA 98666

Archery At Camas Meadows Owners Assoc
PO Box 61962
Vancouver WA 98666

Archery At Camas Meadows Owners Assoc
PO Box 61962
Vancouver WA 98666

Hunt Camas Land LLC
8815 122nd Ave NE Ste 200
Kirkland WA 98033

Victor Lagoa
6524 NW Lambert Ln
Camas WA 98607

Douglas Burckhard
5789 NW Hood Lp
Camas WA 98607

Adele Homsher
6510 NW Lambert Ln
Camas WA 98607

Stephen Liss
6504 NW Lambert Lane
Camas WA 98607

Mark Skolnick
6458 NW Lambert Ln
Camas WA 90730

Village At Camas Meadows Hoa
701 Columbia St Ste111
Vancouver WA 98660

Village At Camas Meadows Hoa
701 Columbia St Ste111
Vancouver WA 98660

Neal Erickson
6416 NW Olympic Ln #45
Camas WA 98607

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Alexandra Sosa
20427 NE 64th Pl
Redmond WA 98053

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Pradnya Khalate
3877 NW 65th Ave Unit 91
Camas WA 98607

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Questions/Comments: The public hearing will follow the quasi-judicial process described within Camas Municipal Code §18.55.180. Comments related to this development may be submitted as follows: (1) In person by testifying at the public hearing; (2) by regular mail to Community Development Department staff, Lauren Hollenbeck, Senior Planner, at Camas City Hall, 616 Northeast Fourth Avenue, Camas, WA 98607; (3) by phone at (360) 817-1568; or (4) by email to: communitydevelopment@cityofcamas.us. It is preferable that written comments be received at least five working days prior to the public hearing, in order to be available with the online agenda and materials. After the agenda has been posted online, all other written comments must be received no later than noon (12:00 p.m.) the day of the hearing, in order for those comments to be handed to the Hearings Examiner by Staff. Written and oral comments may also be submitted in person during the hearing.

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Participate: All citizens are entitled to have equal access to the services, benefits and programs of the City of Camas. Please contact the City Clerk at (360) 817-1591 for special accommodations if needed. The City will provide translators for non-English speaking persons who request assistance at least three working days prior to a public meeting or hearing.

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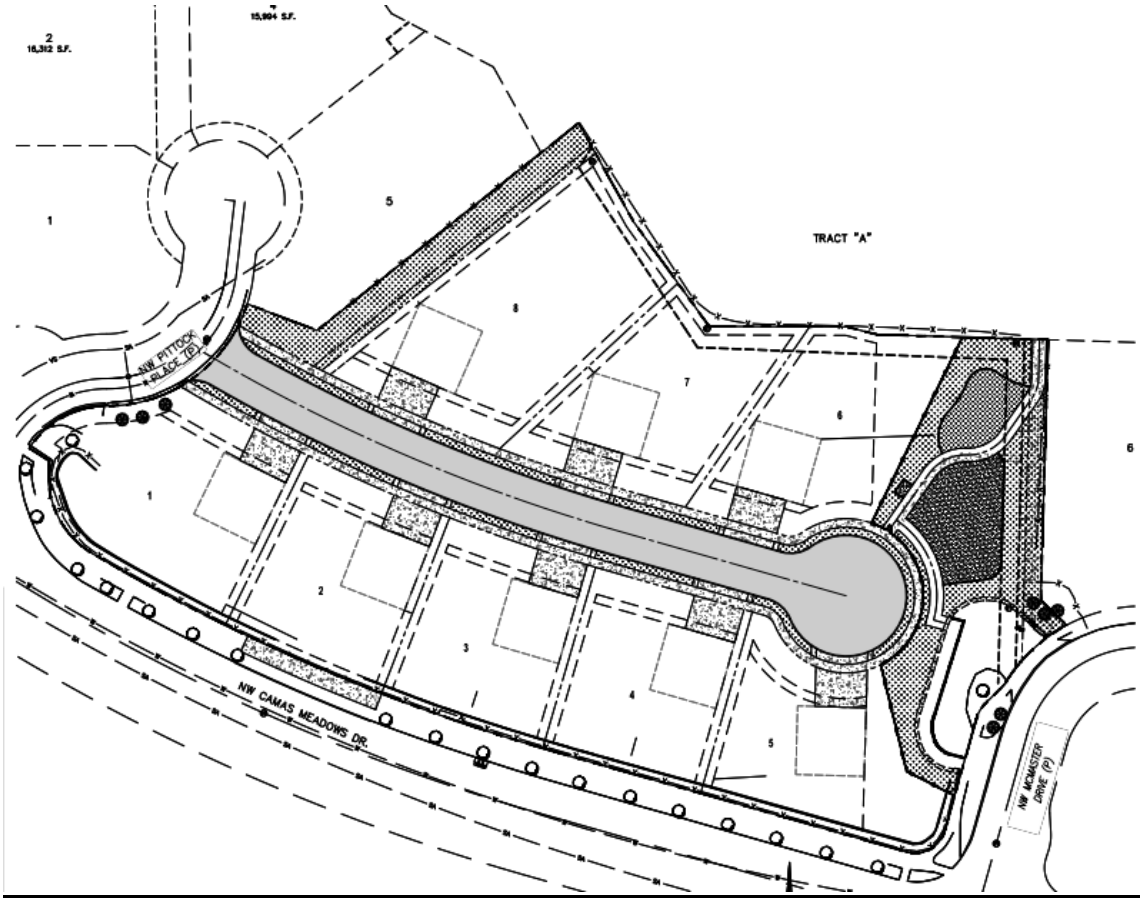
*archaeological information is exempt from public disclosure per RCW 42.56.300

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VICINITY MAP



CONCEPTUAL SITE PLAN



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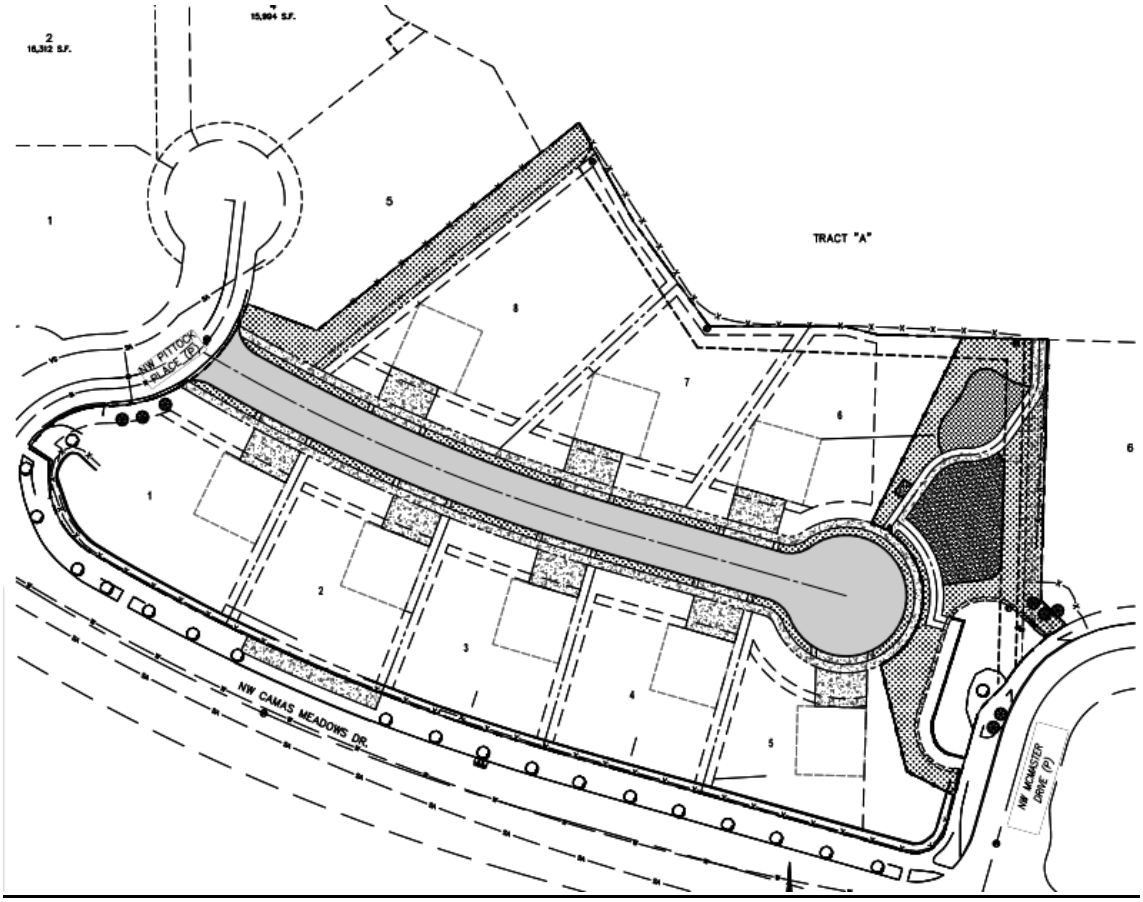
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Notice of Proposed Development

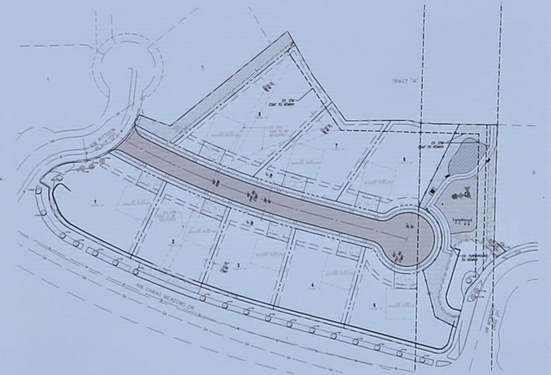
"Parklands II Short Plat"

An application for approval of an 8 Lot Short Plat & Plat Alteration has been submitted to the City of Camas.
The proposal includes 8 single-family lots in the R-15/ BP zones with necessary stormwater, landscaping and a park. Private road improvements are proposed. Adjusting the existing stormwater and path easements on-site with the Plat Alteration to work with the updated design.

Applications applied for with City:

Short Plat and Plat Alteration in a combined Type III review, Fire Dept. review.

Case # SP26-1005 & PLATALT26-1001



Public Hearing Schedule:

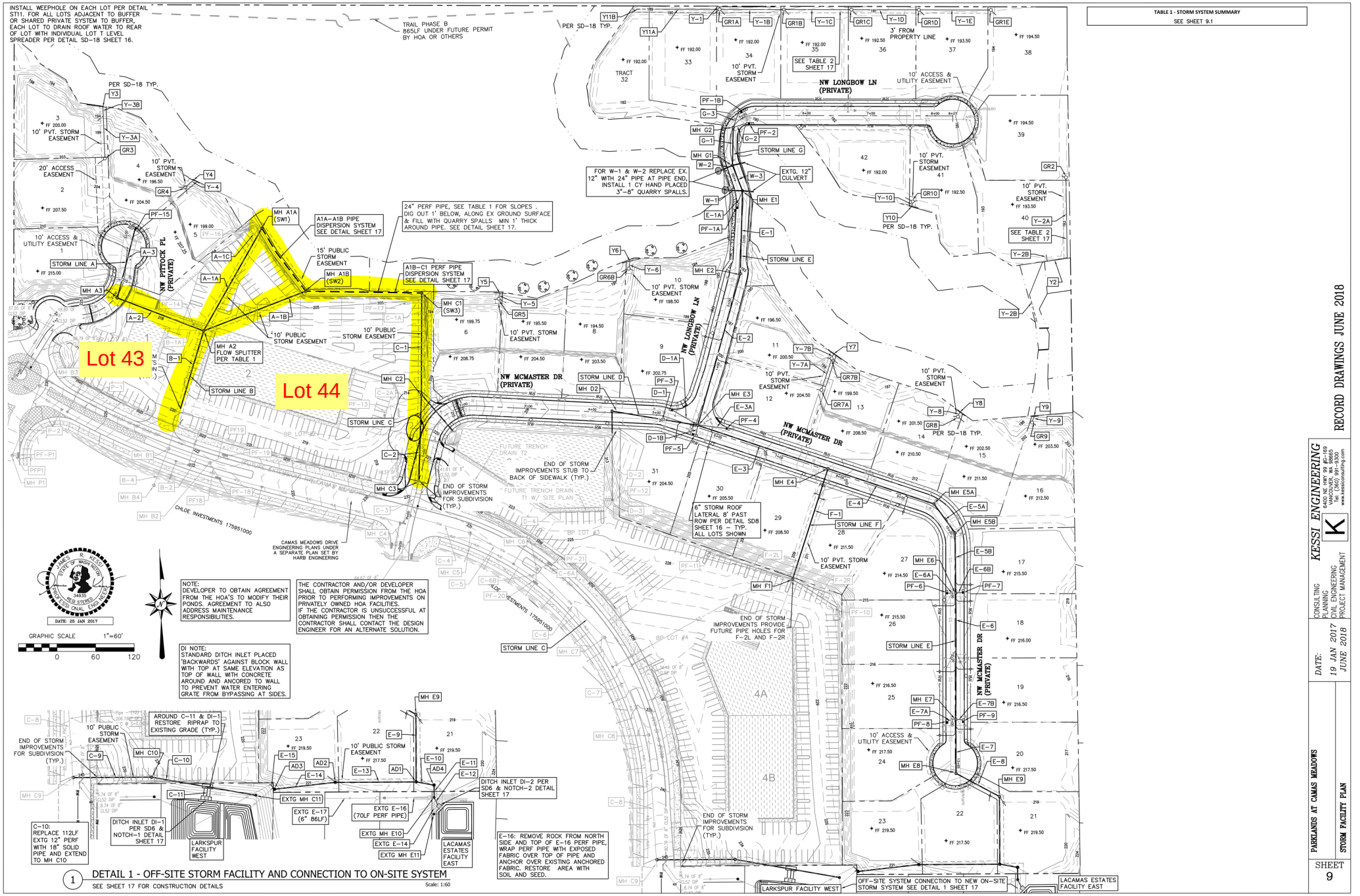
Hearing Date/Time: 11-10-26 @ 4 PM.
Hearing Location: 616 NE 4th Ave.
Camas, WA 98607 or via Zoom.

For information regarding this project contact:

Applicant contact: Scott Taylor, 360-993-0911 or staylor@sgaengineering.com

City Contact: Lauren Hollenbeck, Planner, 360-817-7253, LHollenbeck@cityofcamas.us





RECORD DRAWINGS JUNE 2018

KBSSI ENGINEERING
CONSULTING PLANNING CIVIL ENGINEERING PROJECT MANAGEMENT
6400 NE HWY 99 #G-180 VANCOUVER, WA 98665
Tel: (360) 891-3300 www.kbssiengineering.com

DATE: 19 JAN 2017 JUNE 2018

PARKLANDS AT CAMAS MEADOWS

STORM FACILITY PLAN

SHEET 9

Parklands II Short Plat (SP26-1005 & PLATALT26-1001)
Index of Exhibits

Exhibit No.	Title/Description	Document Date
1	Applicant's Narrative	4/2/26
2	Deviation Narrative	4/2/26
3	Mailing Labels	
4	Property Owner Signature Plat Alteration	3/19/26
5	RCW Plat Alteration	
6	Pre-application Conference Notes (PA25-1057)	6/6/2025
7	Transportation Impact Study (TIS)	3/30/26
8	Preliminary Stormwater Plan & Technical Information Report (PTIR)	5/4/26
9	Preliminary Stormwater Statement	4/3/26
10	Original Preliminary Site Plans	4/3/26
11	Application Review Letter	4/30/26
12	2nd Application Review Letter	6/24/26
13	2nd Application Review Letter SGA Responses	
14	Technically Complete Letter	7/27/26
15	Preliminary Geotechnical Report	6/23/15
16	2016 Final Storm TIR	12/29/16
17	Recorded Estates at the Archery Subdivision Plat	11/27/17
18	Parklands-Archery CC&R's	12/22/17
19	Title Report	5/13/21
20	2022 PROS Plan Trail Map	
21	Existing T-1 Trail	
22	Development Agreement Amendment	5/9/25
23	GIS Packet	11/4/25
24	Updated Preliminary Site Plan	7/7/26
25	Affidavit of Mailing Notice of Application	8/5/26
26	Notice of Application	8/6/26
27	Affidavit of Mailing Notice of Public Hearing	10/21/26
28	Notice of Public Hearing	10/22/26
29	Parklands II Sign with Hearing Date & Time Photo	
30	Existing Retaining Wall & Fence	
31	Parklands Storm Lots 43 & 44 As-built	1/19/17