TOWNSHIP OF ORION
OAKLAND COUNTY, MI

Engineering Standards

Adopted: April 2016

PREPARED BY: OHM Advancing Communities®

ARCHITECTS. ENGINEERS. PLANNERS.

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GENERAL PLAN SUBMITTAL REQUIREMENTS AND REVIEW PROCEDURES

I. PLAN SUBMITTAL PROCEDURES

A. The plan review and approval process consists of two (2) separate review submittals as required by the Planning and Zoning Department (PZD). The Township's engineer conducts these reviews, which must be completed before construction can begin.

1. The first review submittal is of the SITE PLAN.
    a. The SITE PLAN shall be provided in accordance with The Charter Township of Orion Planning Commission Outline of the Site Plan Review Procedures (http://oriontownship.org/GeneralInformation/Information/Forms.aspx#planning) and Section 30.01- Site Plan Review Procedures and Standards (page 30-3, of the Zoning Ordinance 78). The SITE PLAN application can also be located through the provided link.
        i. Once all applicable Township Departments give approval, the SITE PLAN must be presented for approval to the Planning Commission and Township Board (for PUD's). A review of the impacts on any existing woodlands or wetlands is conducted prior to being presented to the Planning Commission and Township Board as well.

2. The second review step for a project is the ENGINEERING PLAN review.
    a. The ENGINEERING PLAN must address the same concerns as the site plan but shall include the required information in greater detail. The application for this submittal can be obtained from the PZD. Additionally, if a Soil Erosion permit is required for the site it shall also be applied for at this time. (http://oriontownship.org/GeneralInformation/Information/Forms.aspx#planning)
        i. Upon receipt of the Planning Commission and Township Board (if applicable) approval of the SITE PLAN, an Engineering Plan Review application, a signed and sealed cost estimate, two (2) bond sets of signed and sealed engineering plans and one (1) electronic set (pdf) for site improvement are to be submitted to the Township PZD.

II. PREPARATION OF ENGINEERING PLAN

A. **ALL ENGINEERING PLAN SUBMITTALS MUST ORIGINATE AT THE PLANNING/ZONING DEPARTMENT.**

B. Plans are forwarded from PZD to the Township Engineer. The engineers will review the total site for the Township, concentrating on water, sanitary, storm water detention/retention and soil erosion control. Site grading and paving will be checked as part of the storm design. A cost estimate and all relevant calculations are required,

as noted in these Standards. If additional information is needed, the Township Engineer will contact the Design Engineer directly.

1. As part of the review process, the Township Engineer may contact the PZD, the Department of Public Works (DPW), Fire Department and Oakland County Sheriff's Department for comments and feedback. If other agencies (MDOT, RCOC, etc.) have not completed their reviews, the Township Engineer may request that their comments be supplied to the Township Engineer prior to final approvals.
2. When plans are complete and ready to be stamped approved the Township Engineer will request additional sets of plans be submitted for distribution to regulatory agencies for public improvements. In general, 4 sets of water main plans, 9 sets of sanitary sewer plans and 9 complete sets (for distribution to other Township Departments) are required. The permitting plans shall include a location map, a quantity list with private and public water main or sanitary sewer indicated, a utility plan sheet, and the current Charter Township of Orion Standard Water Main or Sanitary Sewer Detail Sheets. All plan sets must be signed and sealed by an engineer registered in the State of Michigan.
3. A water main permit is required for the addition of public main in excess of 100'. Water main plans along with a completed Michigan Department of Environmental Quality (MDEQ) Permit Application for Water Supply Systems (Act 399 of 1976, as amended) shall be provided to the Township Engineer. It is recommended that the Streamlined Water Main Permit Checklist be completed in order to expedite permit issuance. The most recent version of the application and the checklist can be obtained on the MDEQ website, http://www.michigan.gov/deq/. The applicant must complete the *Project Basis of Design*, including Item G by contacting the Township Engineer to obtain pressure and flow values from the hydraulic model. This test can be scheduled by contacting the Fire Department at (248) 391-0304 ext. 143. The WSSN for the Charter Township of Orion is 5035 and for the GLWA is 2838. The Township Engineer will have the DPW Director execute the permit application and then will forward the application and plans to the MDEQ for permitting.
4. All public sanitary sewer extensions require a construction permit. Sanitary sewer plans along with a completed MDEQ Sanitary Sewer Permit Application (Part 41 of Act 451 of 1994, as amended) shall be provided to the Township Engineer. The most recent version of this application can be obtained on the MDEQ website. The Township Engineer will provide the flow rates and units for Items 21-24 on page three of the application. Additionally, the Township Engineer will have the DPW Director execute the permit application and then will forward the application and plans to the Oakland County Dept. of Public Works. It is recommended that the design engineer complete the Streamlined Sanitary Sewer Permit Certification Checklist in order to expedite permit issuance. Upon their approval, the plans will then be forwarded to the GLWA and finally to MDEQ for permitting.
5. All public improvement plans submitted for permits must carry the seal and signature of the Design Engineer along with the approval stamp of the Charter

Township of Orion. Note that lineal footage and type of sanitary and/or water main pipe must be summarized on the cover sheet and, depending on which permit is necessary, the Charter Township of Orion Standard Water Main or Sanitary Sewer Details shall be included within the engineering plans.

6. Upon final plan approval and receipt of all permits, but prior to commencing construction, a pre-construction meeting shall be held.
    a. The Developer or Developer's Authorized Representative shall contact the Township Engineer to schedule the pre-construction meeting. The following attendees are required, at a minimum, from the developer's team: The Developer or Developer's Authorized Representative, the Design Engineer, the General Contractor and/or the Underground Contractor and the Paving Contractor. Prior to scheduling the meeting, proof of payment of the required construction escrow, SESC escrow, performance guarantee, and SESC guarantees as specified in the Engineering approval letter shall be submitted to the Township PZD.
    b. The contractor shall provide, at the Pre-construction Meeting, proof of general liability insurance (project name appearing in description area) endorsing the Charter Township of Orion and its Engineer as additionally insured. Policies are required to provide coverage up to $3,000,000 for each occurrence and $3,000,000 aggregate. Standard language regarding cancellation will be upgraded to "30 days written notice" for cancellation and the language "failure to do so shall impose no obligation or liability of any kind upon the insurer, its agents or representatives." will be removed or crossed off. See *Appendix A* for example of properly completed insurance form.
    c. The final approval letter from the Township Engineer will detail the total amount of fees required for the project, which typically include construction escrow, SESC escrow, performance guarantee, SESC guarantee, and Maintenance & Guarantee Bond. A description of the basis for the escrow and bonds can be viewed in *Appendix B*, as well as the approved form for the Maintenance & Guarantee Bond.
    d. Final occupancy permit will require a passing DPW final inspection, approval of reproducible record plans, an electronic pdf of the record plans, a GIS file of the as built utility information, maintenance and guarantee bond, and recorded easements including a legal description and sketch. A grading certificate may also be required if requested by the Charter Township of Orion. The design engineer shall note that the GIS file shall be in NAD83 State Plane Michigan South Intl Feet. If submitting vertical elevations, they shall be in NAVD88. The developer's engineer should contact the Township Engineer to be provided a blank schema to facilitate the GIS submission. An AutoCAD file is acceptable in place of a GIS file if, and only if, the developer's engineer does not have GIS capabilities.
    e. Unused construction escrow, soil erosion escrow, and guarantee funds will be eligible for return as described in the final approval letter.

III. PERMITTING AGENCIES

TOWNSHIP DEPARTMENTS:

Planning and Zoning Department
Tamara Girling
Planning and Zoning Director
2525 Joslyn Road
Lake Orion, MI 48360
Phone: (248) 391-0304 ext. 159

Public Works Department
C. William Ireland
Director of Public Works
2525 Joslyn Road
Lake Orion, MI 48360
Phone: (248) 391-0304 ext. 118

Building Department
Randy McClure
Building Official
2525 Joslyn Road
Lake Orion, MI 48360
Phone: (248) 391-0304 ext. 124

TOWNSHIP ENGINEERS:

OHM Advisors, Inc.
34000 Plymouth Road
Livonia, Michigan 48150
Phone: (734) 522-6711
Contact: James C. Stevens, P.E.

OTHER REVIEW AGENCIES:

Great Lakes Water Authority
735 Randolph, Suite 1900
Detroit, MI 48226
Phone: (313) 964-9501
Fax: (313) 842-6538
Contact: Robert J. Daddow
Phone: (248)-858-1650.
Email: daddowr@oakgov.com

Oakland County Drain Commission
One Public Works Drive
Waterford, Michigan 48328-1907
Phone: (248) 858-0958

OTHER REVIEW AGENCIES (cont.):

Road Commission for Oakland County
2420 Pontiac Lake Road
Waterford, Michigan 48328
Phone: (248) 858-4804

Michigan Department of Transportation
Lansing Headquarters
State Transportation Building
425 W. Ottawa St.
P.O. Box 30050
Lansing, Michigan 48909
Phone: (517) 373-2090

Metro Region Office
1810 W. Nine Mile Road
Southfield, Michigan 48075
Phone: (248) 483-5100
Fax: (248) 569-3103

Oakland TSC
2300 Dixie Highway
Waterford, Michigan 48328
Phone: (248) 451-0001
Fax: (248) 451-0108

Michigan Department of Environmental Quality
Lansing Headquarters
Phone: (517) 373-7917

SE Michigan District Office
27700 Donald Court
Warren, Michigan 48092-2793
Phone: (586) 753-3700
Fax: (586) 751-4690

ADDITIONAL PERMITTING INFORMATION

A. A ROW Permit from the Road Commission for Oakland County (RCOC) is necessary for all work within ROWs maintained by RCOC. Most roads within the Township limits are maintained by RCOC, with the exception of local private roads and Lapeer Road (M-24)

B. A ROW Permit from the Michigan Department of Transportation (MDOT) is necessary for work within ROWs maintained by MDOT. Lapeer road (M-24) (Charter Township of Orion limits, Brown/Dutton Road, to Oxford Township limits, Indian Lake Road) is an MDOT road.

C. The Village of Lake Orion is surrounded by Orion Township, any work within the Village limits will need be approved by the Village of Lake Orion.

D. The Design Engineer shall submit plans to RCOC for review of any work proposed within County rights-of-way. The Township will request the Developer/Design Engineer to submit the RCOC review comments and Permit prior to final approval. Note that the Township's standards for entrance drive or other improvements may be more stringent than RCOC requirements.

E. On state highways, approach improvements or use of drainage facilities must have approval of the Michigan Dept. of Transportation (MDOT). The Design Engineer shall submit plans to MDOT for review of any work proposed in state rights-of-way. The Township will request the Developer/Design Engineer to submit the MDOT review comments and permit prior to final engineering approval. Note that the Township's standards for entrance drive or other improvements may be more stringent than RCOC requirements.

F. The Charter Township of Orion, as a municipal enforcing agency (MEA), is the Soil Erosion Control Agent for all work performed in the Township. Soil Erosion and Sedimentation Control Plans shall be submitted to the Township for all sites greater than one acre or within 500' of a lake or stream. The Township will require a Soil Erosion and Sediment Control (Part 91 of Act 451 of 1994) Permit prior to final engineering approval. Upon receipt of the Part 91 permit, all sites with construction activity that disturbs more than five (5) acres of land must submit a Notice of Coverage to MDEQ Surface Water Quality in Lansing. Forms are available at the MDEQ website, http://www.michigan.gov/deq/. Notice of Termination is also required upon completion.

G. The Oakland County Water Resource Commissioner (OCWRC) reviews all work associated with County Drains, i.e. tapping an existing drain, work within a County Drain easement, etc.

H. Capital, lateral and tapping fees are assessed by the DPW for sanitary sewer and water main taps, respectively. Contact the Charter Township of Orion DPW for more information, (248) 391-0304 ext. 117.

ENGINEERING PLAN REQUIREMENTS

I. PLAN REQUIREMENTS

A. GENERAL

1. It is recommended that plans be submitted on 24" x 36" paper.
   a. Minimum horizontal scale: 1” = 50’
   b. Minimum vertical scale: 1” = 5’
2. A general plan at 1" = 100' or 1" = 200' needs to be included when the size of site prohibits a single plan sheet at 1” = 50’. Provide street names, units, utilities, pavement, site dimensions, and phase lines on the general plan. Setbacks and building separations shall be noted in accordance with the zoning requirements and the approved site plan.
3. A cover sheet including project name, location map showing major thoroughfares & section number, proprietor, engineer & architect contact information (necessary for forwarding review comments), and Professional Engineer (State of Michigan) seal and original signature shall be submitted with the plan set.
4. A title block shall be used for each sheet.
5. Appropriate sidwell numbers, lot number (if multiple lots), parcel dimensions, property zoning, building use and adjoining rights-of-way shall be shown. Additionally, the property owners and zoning shall be shown for all adjacent properties.
6. The Charter Township of Orion Standard Notes and Charter Township of Orion Fire Department Notes shall be included in the plan set. See *Appendix C* for these notes. The Standard Details (available by contacting the Township Engineer) are required with the permitting and final plan submittals.
7. A minimum of two benchmarks must be shown on the general plan. See *Section II Topographical Survey* for additional requirements.
8. A legal description of property shall be included. The description must have an error of closure no less than 1’: 5000’.
9. A striping and traffic control plan for parking lot that indicates the proposed loading area must be included in the submittal.
10. A plan sheet that shows landscaping in accordance with zoning requirements and the approved Site Plan shall be provided. All utilities shall be shown on the landscaping plan.
11. Per Oakland County the proposed sanitary sewer shall be shown on the same sheet in both plan view and profile view for each run of sewer. Each sheet shall only show runs from manhole to manhole with no mid run breaks across the sheets. This is in addition to the overall utility plan.
12. The project’s tree survey information shall also be provided (it should not differ from information submitted to the PZD for site plan review). The developer's engineer shall be responsible for coordinating tree removal plans with construction plans. Grading limits shall be shown on the tree removal plan.
13. Wetland limits and size shall be clearly shown, regardless of size/regulation status.
14. Easements for off-site work (grading, sewer, tap, etc.) must be submitted prior to construction. Appropriate notes shall be provided within the plan set.

II. TOPOGRAPHICAL SURVEY

A. GENERAL

1. Indicate a minimum of 2 Benchmarks based on NAVD88 or NGVD29 (USGS).
2. Show property lines indicated by bearing and distance.
3. The existing elevations shall be provided so that the drainage pattern can be established. On parcels of more than one (1) acre, topography on the site and within one hundred (100') of the site at two-foot (2 ft.) intervals, must be shown.
4. Proposed elevations shall be shown at property corners and along property lines with sufficient on-site elevations or contours to establish site drainage.
4. Show all existing conditions, including but not limited to: ditches, culverts, utilities (invert and casting elevation), sidewalks, power poles, easements, building footprint and finish grade, finish grade of adjacent buildings, wetlands and woodlands, flood plains etc.
5. Show existing adjacent roads with ROW. Grades must be shown at ditch centerline, top of bank, edge of shoulder, edge of pavement or top of curb and pavement centerline. Grades must be shown on both sides of the road.
6. Show the locations of all existing gas, electric, cable and phone lines.

III. UTILITIES (GENERAL)

A. GENERAL

1. No new utilities are to be placed underneath building footprint. For existing utilities to be abandoned within the influence of the foundation and pavement, the following criteria shall apply:
    a. Abandoned utility less than 5' below footing/pavement ---Remove existing utility.
    b. Abandoned utility more than 5' below footing/pavement ---Grout existing utility full as directed, using standpipe to prevent air voids. Provide calculations showing the volume (in cubic feet) of grout required on plans.
    c. Abandoned utility not within influence (assume 1:1 trench) of footing/pavement ---bulkhead as required by Township, unless utility is determined by the Township to be a hazard, nuisance, or potential maintenance problem.
2. Water Main and Sanitary Sewer must be extended across property frontage(s) or to a property line as directed by the Township.
3. Provide a sleeve (casing pipe) when utilities must cross retaining walls.
4. No water main or sanitary sewer will be allowed within ten (10) feet, measured horizontally, of the high water elevation of basins.
5. All utilities shall be shown on the site, engineering, and as-built plans, including those that will not be Township maintained. All utility crossings shall specify top and bottom of pipe elevations and finished grade elevations.
6. Ensure that all utilities (water, storm, sanitary) are all traceable, including utility leads.
7. No trees shall be planted in the sanitary sewer, storm sewer or water main easements.

IV. WATER MAIN

A. GENERAL

1. Quantity list on the cover sheet or utility sheet of the plans. (This location is required for permitting purposes.)
2. Looped water main may be required based on Township review.
3. 10' horizontal separation required between water main and either sanitary or storm sewer. All other utilities shall be located outside the limits of the water main easement. (See item 7 below.)
4. 18" minimum vertical clearance between water main and all utilities, i.e. storm, sanitary sewer, electric, gas, phone, etc. Top and bottom of pipe elevations shall be indicated on the profile with crossing noted on plan view.
5. All fittings, valves, hydrants shall be dimensioned from property corners or located by State Plane Coordinates.
6. Tapping sleeve and valve (TS&V) shall be used to connect to existing mains unless connection can be made without interrupting service on the main. A like sized tap (i.e. the proposed main is the same size as the main to which it will connect) can only be constructed when the existing main is ductile iron. Additionally, a mechanical tapping sleeve must be utilized, not the typical stainless steel tapping sleeve. A gate valve and well is also required at all extensions of municipal water main.
7. Minimum 12' wide exclusive easement must be shown on the plans and must extend to the property lines where future connections are anticipated.
8. Water main cover shall be 5.5' to top of pipe, with 4' minimum allowed at ditch/utility crossings, in conformance with Charter Township of Orion Standard Water Main Details.
9. Taps for domestic water service from the fire service lead are not permitted, per Fire Department requirements.
10. Testing:
    a. Bacteria samples will be obtained by the Township Engineer. Contact Township Engineer for scheduling.
    b. Prior to bacteria testing, the Contractor will conduct pressure testing with the Township Engineer witnessing on behalf of the Charter Township of Orion. Contact the Township Engineer for scheduling.

B. MAINS

1. Minimum size water main (exclusive of hydrant leads) is 8", with the following maximum dead-end main lengths:
    a. 50' for 6" fire hydrant lead
    b. 600' for 8" main
    c. 1000' for 12" main

    All dead-end mains must end with a gate valve, well, and hydrant. Maximum lengths are subject to modification based on Township review, and may require submittal of calculations showing adequate fire flow and daily turnover.
2. Profiles are required on water main over 12" diameter.

3. Pipe size, length and type are required to be shown in plan view for each run of pipe. Material requirements are as indicated on the current Standard Details.
4. Use of 90□ bends shall be prohibited, and may be placed only as specifically approved in writing by the Township. Minimum length between bends shall be two (2) pipe diameters. Maximum preferred bend size is 45□.
5. Length, size, and invert of casing and pipe shall be shown at all bore locations. Casing pipe is required in the event a water main must pass under a structural retaining wall, and must extend beyond the angle of repose of the retaining wall. Every attempt must be made to direct the water main around any structural retaining wall.
6. Joints shall be restrained per manufacturer or as approved by Township Engineer, tied or harnessed at all deflections of 11¼□ or greater, behind tee outlets, at hydrant shoes, at plugs or caps and at any crosses to prevent lateral movement of the pipe. Concrete thrust blocks shall be required in addition to restraints, unless approval by the Township Engineer is given to exclude thrust blocks. Concrete thrust blocks shall bear against undisturbed earth in all instances and shall have sufficient bearing area to develop the full resultant axial thrust of the pipe at test pressure. The concrete thrust block shall not cover fastener nuts and/or threaded connections that would hinder future maintenance or repairs of fittings or valve assemblies.
    a. Ductile Iron Joints, where required, shall be restrained by an approved mechanical restraining gland or instant push-on restraining device.
    b. Push-on Joints shall be restrained with approved instant joint-retaining device such as Field Lok Gasket manufactured by U.S. Pipe Company or approved equal. A restraining schedule must be submitted and approved by the Township Engineer prior to installation and can be obtained from the pipe manufacturer.
    c. Mechanical Joint-Retaining Glands where allowed shall be the "Megalug Series" as manufactured by EBAA Iron or approved equal.
    d. Thrust blocks, shall be made of 3,000 psi concrete and of adequate size and shape to resist all design working and surge pressures to which the main will be subjected.
    e. All joint materials and lubricants shall be furnished with the pipe, including all material required for connection to existing water mains and appurtenances.
    f. Harnessed joints and steel reinforced concrete anchorage will be required on pipes larger than 16" diameter.

C. <u>VALVES</u>

1. Valve spacing: 800' maximum inline, or less, based on requirements of item #2.
2. The following requirements need to be met in the event of a breakage:
    a. A maximum of three valves shall be used to isolate break.
    b. No more than 2 hydrants can be out of service.
    c. No more than 24 single family units or 30 multiple units out of service.
    d. Subject to modification based on Fire Department review.
3. Valves shall generally be located outside of sidewalk/pathway.

4. Gate wells are required for all valves that are 6” diameter and larger. Valves that are 2” and smaller only require a box. Valves between 3” and 4” that require a tapping sleeve for installation shall be placed in a gatewell, otherwise a box is acceptable.

D. HYDRANTS

1. Hydrant spacing:
    a. Residential: 500' maximum
    b. Commercial, industrial or multiple: Spacing of hydrants shall be considered as individual cases, and shall be determined by consultation with the Fire Department and the Director of Public Works.
2. Hydrants must be protected by 6" curb in parking areas. The Township can at its discretion approve standard hydrant posts.
3. No parking within 10' of a hydrant.
4. Hydrants to be placed between 3' and 10' of the back of curb.
5. Hydrant leads shall be restrained joint only, per Standard Detail Sheet. In addition to restraint joint, thrust blocks shall be placed at hydrants, unless otherwise approved by the Township.
6. Gate wells should not be used for hydrant valves; all hydrant valves shall be installed in boxes.
7. Any hydrant proposed for relocation shall be the current required model per the Water Main Standard Details; if not, a new hydrant shall be used. A note shall be placed on the plans stating this requirement.

E. METERS

1. All users (homes, businesses, commercial buildings, etc.) shall have approved type meters installed. Contact Charter Township of Orion DPW at (248) 391-0304.

F. WELLS

1. All wells, pumps and pump housings shall be permitted and constructed as required by current Oakland County and Michigan Department of Public Health requirements, standards, and specifications.
2. Private wells must be separate and independent of the Township water system.
3. Where a well is to be abandoned, it shall be capped as required by Oakland County and Michigan Department of Public Health requirements, standards, and specifications.

G. METERS AND SERVICE LINES

1. The Charter Township of Orion Water Department will make the tap only on all water services 2-inches and fewer inches in diameter. The contractor will be responsible for installing the lead.
2. All water service connections shall include corporation stops, service pipe, and either curb stops and boxes (for 2" and smaller), valve and box (for 2" to 4"), or

gate valve and well (for larger than 6"). Where possible, the curb stops and box shall be set in the road ROW, 6" from the property line. Otherwise, all curb stops and boxes shall be located within a dedicated water main easement.

3. Stops and boxes shall not be placed within existing or proposed pavement, unless there is no alternative, or if otherwise required by the Township. Stops placed within existing or proposed pavement will be required to be housed in a valve box and cover per the standard details.
4. Water service size shall be 3/4" minimum.
5. All water services up to 2" diameter shall be either Type K soft copper or Poly Blue PVC with a pressure class of 200 psi to the meter. If PVC is used, a tracing wire shall be run from the meter setup to the curb box.
6. All water services greater than 2" diameter shall be Class 54 ductile iron pipe.
7. Meters shall be purchased from the Charter Township of Orion Water Department.
    a. 3/4", 1", and 1.5” meters shall be installed by the Township.
    b. 2" (or larger) meters shall be installed by a licensed plumber.

H. MATERIALS AND CONSTRUCTION METHODS

1. All proposed water systems shall be constructed in compliance with these standards and the Charter Township of Orion Water Main Standard Details.

V. SEWERS (SANITARY/STORM)

A. GENERAL

1. Storm and sanitary sewer size, grade and manhole spacing table:

Size	Std. Grade (%)	Min. Grade (%)	Max. Grade (%)	Std. Run (Ft)	Max. Run (Ft)
8”*	0.80	0.40	8.0	300	350
10"	0.60	0.30	6.2	300	350
12"	0.40	0.22	6.0	300	350
15"	0.24	0.16	3.6	300	350
18"	0.18	0.12	2.8	300	400
21"& greater	0.14	0.10	2.2	300	400

* The minimum allowable sanitary sewer size is 8” diameter.

* The minimum allowable storm sewer size is 8” diameter.

2. The following must be shown on plan view for storm and sanitary sewer plans:
   a. Size of pipe
   b. Length between structures
   c. Easement (where required)
   d. Progressive numbering system for all structures.
   e. Dimension to property lines, or coordinates related to a property corner.
3. Profiles must be shown with the following information for storm and sanitary sewer plans:
   a. Length, type, class, size and slope of pipe between structures
   b. Top of casting and all sewer inverts at all structures
   c. Existing and proposed ground elevations
   d. All utility crossings
   e. Special backfill areas, i.e., compacted sand
   f. Provisions for infiltration testing (sanitary sewer only)
   g. Hydraulic Grade Line (storm sewer only)
   h. Progressive numbering system
4. All structures shall be dimensioned from property corners or located by State Plane Coordinates.
5. A structure will be required at all changes in alignment, size or grade and at all junction points.
6. No “blind” taps of mainline sewer shall be allowed into the existing system. All such taps will require the installation of a standard structure (i.e. manhole or catch basin). Taps for sewer leads do not require a structure.
7. Where Manning's equation is required to compute flow, minimum value for "n" shall be 0.013 for sewers (even if a smoother pipe is accepted), 0.025 for culverts, and 0.035 for open channels.
8. All sewer construction is required to maintain a minimum 10’ horizontal separation between the sewer and water main. Additionally, an 18” minimum vertical clearance is required between the sewer and water main.

B. MATERIALS AND CONSTRUCTION METHODS

1. All proposed sewer systems shall be constructed in compliance with these standards and the Charter Township of Orion Sanitary Sewer/Storm Sewer Standard Details. The current allowable sewer material types are as follows:
    a. Building Leads – S.D.R. 23.5 ABS pipe or Schedule 40 PVC
    b. Sanitary Sewer: PVC Truss Pipe (ASTM D2680) (Diameter - 15" or less)
    c. Storm Sewer: Shall follow all manufacturer specifications and all County standards
    d. Reinforced Concrete Pipe (Sanitary Sewer: Diameter – 18" or larger, Storm Sewer: All sizes)
        i. RCP CL. IV for a depth up to 14 feet
        ii. CL. V for a depth 14 feet to 24 feet
        iii. Special design for depth greater than 24 feet
        iv. RCP CL. III may be allowed in some cases if engineer provides calculations to show CL. III pipe can withstand the loading.

VI. SANITARY SEWER

A. GENERAL

1. Indicate building lead size, locations and invert elevation at building or finish grade of building. (Minimum 6" diameter at 1% slope.) Verify and indicate elevations at crossings with all other utilities.
2. Testing:
   a. Township Engineer and Orion Township will inspect sanitary taps into existing structures. The Contractor shall contact Township Engineer and Township to set up inspection. Additionally, the Contractor is responsible for ensuring a permit has been pulled for the OCWRC tap.
   b. Sanitary air test will be conducted by the Contractor with the Township Engineer witnessing on behalf of the Township. The Contractor shall contact Township Engineer for scheduling.
3. Added depth may be required for sewer extensions to provide future service to the sewer district.
4. In sanitary sewers where construction of building sewers (leads) to the property line is not required, a wye branch (tees not allowed) shall be installed for each lot or potential building site.
5. Minimum 20' wide exclusive easement. Increase may be required due to depth of sewer.
6. Leads shall not be connected to manholes unless specifically approved by the Township for a connection to the last manhole.
7. Pump stations will not be allowed unless there is no other alternative for sewer service. If a lift station is required, standard design details shall be purchased from the Charter Township of Orion for use.
8. Prior to acceptance of the sewer, the developer or contractor shall provide a videotape or approved digital image file of the sewer (with flows) to the Township. The video shall be taken no less than 30 days after installation.
9. Casing pipe is required in the event a sanitary sewer must pass under a structural retaining wall, and must extend beyond the angle of repose of the retaining wall. Every attempt must be made to direct the sanitary sewer around any structural retaining wall.

B. DESIGN CRITERIA

1. Quantity list and design data (on the cover sheet or utility sheet of the plans) in conformance with current 10 States Standards shall be included. See *Appendix E* for a copy of the OCDC Schedule of Unit Assignment Factors and an example of a typical basis of design.
2. Velocity: Minimum = 2.0 fps; Maximum = 10.0 fps.
3. The maximum depth to invert of any sanitary sewer pipe shall not exceed 80% of the manufacturer's recommendation.
4. Whenever there is a change in direction in a sewer at a manhole, an allowance of 0.10 feet in grade shall be made for loss of head through the manhole.
5. Whenever there is a change in pipe size, the inverts of both sewers shall be set at a grade so that both sewers maintain the same energy gradient.

6. Minimum size for sewer shall be 8” diameter.
7. Materials, bedding, joints, manholes, and other appurtenances shall be as specified or shown on the Standard Details.
8. 4' minimum cover required over mains and leads.

C. DROP CONNECTIONS

1. Drop connections shall be constructed according to the Standard Details. A drop connection is required when there is an 18” vertical difference between inverts on outlet and inlet pipes. Drop connections are to meet the following requirements:
    a. If the drop manhole is to be part of the new construction, then a five (5) foot pre-cast structure with internal drop connection shall be used.
    b. If the existing manhole is deemed large enough to accommodate an interior drop by the system owner (i.e. Oakland County DPW or Charter Township of Orion DPW), then an interior drop that utilizes a drop bowl can be constructed. Otherwise, an exterior drop connection must be constructed.

D. INFILTRATION

1. The infiltration rate for all sanitary sewers shall comply with current Oakland County Standards.

E. PUMP STATIONS

1. Any proposed pump station shall be considered on a case-by-case basis by the DPW and Township Engineer, according to existing and proposed site conditions and according to all current local, County and State requirements.

VII. STORM SEWER

A. GENERAL

1. It shall be unlawful for any person to interfere with or obstruct flow of surface water over easements for public utilities or to impede the flow of surface water across private property in a manner different from the approved grading plan and drainage pattern.
2. A storm district drainage map shall be provided for all plan submittals, showing the storm system, sub-areas contributing to each structure and/or system, along with the overall drainage district limits. Areas and structures should be labeled and correspond with the calculations.
3. Upstream (pass through) drainage shall also be accommodated. Smaller sites may only need to indicate the quantity of flow, contributing acreage, and point of entry (with an arrow, etc.). Larger sites will be required to provide a contour map, at no more than 1"=200'.
4. Where retention is required, storage volume must be provided for all acreage contributing to the basin, including that acreage off-site.
5. Where detention or retention is required, a sediment forebay designed to capture the runoff from a 1-year storm event shall be included.
6. Storage may be allowed by either an in-line or off-line basin. See the appropriate section of these Standards for basin requirements.
7. Discharge cannot be diverted onto adjoining properties.
8. Existing drainage patterns shall be maintained.
9. Connections at storm structures: roof drains may flow overland or be connected at a structure; direct tap connections are allowed only when provide with a core and boot. If sump discharge is connected to storm sewer, 4” is the minimum diameter pipe to be utilized.
10. Size the pipe downstream of outlet to carry the flow from all on-site and off-site contributing area for a 10-year storm event.
11. All storm drainage from truck wells shall pass through an approved oil/gas separator structure. Capacity of the structure shall be based on the contributing area. The Township may require an oil/gas separator for certain proposed site uses that potentially pose a threat to drainage contamination.
12. A note shall be added to the plans stating that the owner will regularly clean and maintain all storm sewer and detention basins per the Township’s Stormwater Management and Erosion Control Ordinance No. 139.
13. Casing pipe is required in the event a storm sewer must pass under a structural retaining wall, and must extend beyond the angle of repose of the retaining wall. Every attempt must be made to direct the storm sewer around any structural retaining wall.
14. Side slopes of all open channels and/or ditches shall be no steeper than 1 vertical to 4 horizontal.

B. DESIGN CRITERIA

i. Design calculations shall be submitted with hydraulic grade line computed.

ii. Attempt to keep hydraulic grade line (HGL) within pipe. At no time shall HGL be within two feet of the top of casting elevation. Where edge drain is used, HGL shall also be kept below invert of the edge drain. When starting HGL from an existing pond or other water area, the 100-year elevation shall be used.

iii. Design shall minimize standing water in all storm sewers, existing and proposed.

iv. Design: Q = CIA, Rational Method.

a. 10-year storm, $I = 175/(T_c+25)$ with an <u>initial</u> $T_c = 20$ minimum for residential development; shall be less for non-residential development, based on the actual time of flow from the most distant point of flow measurement.

b. Larger sites should use a more appropriate method of determining flow. For watersheds up to 20 square miles, the suggested method for determining surface runoff is the Soil Conservation Service (SCS) Methodology. The computations should be based on the Type II rainfall distribution, 10-year, 24-hr storm. It is the responsibility of the design engineer to determine the best method to use for the site.

c. Typical composite runoff coefficient, C:

	C
Agricultural/Undeveloped	0.20
Single Family Residential	0.35
Multiple Family	0.55
Commercial & Industrial	0.70
Completely Paved/Open Water	0.95

These coefficients are recommended minimums and may not be sufficient based on Township review - use surface runoff coefficients for each sub-area.

d. Typical surface runoff coefficients, C:

Surface	**C**
Open Water	1.00
Pavement	
Asphalt and Concrete	0.90
Brick	0.90
Aggregate	0.65
Roofs	0.90
Lawns	0.20

NOTE: Surface area of detention/retention ponds shall be considered to be open water. Calculations shall consider the pond area at the peak (100-year) storage elevation.

e. Velocity: Minimum = 2.0 fps; Maximum = 10.0 fps. Velocities exceeding 5 fps (or less depending on soils) will require erosion protection at outfall.

f. Use the "Manning" equation to calculate the flow capacity.

g. The runoff coefficient calculation must be included with plan submittal.

v. Sewer requirements:

a. All storm sewer shall be sized for the flow generated from a 10-year storm event. Calculations shall take into account both on-site and off-site contributing area.

b. All storm sewer shall be shown in profile.
c. 8" diameter minimum pipe size.
d. 4’ diameter minimum for manholes and catch basins.
e. 2’ diameter minimum for inlets – allowable for use when only one 12” pipe is connected to the structure (discharge pipe) and when preceding a structure with a sump.
f. Minimum cover of 2'-6". MDOT "low head" required instead of cone/corbel if less than 4 feet of cover over pipe at structure, unless structure is 2' diameter. Plan & profile shall specify "low head" where necessary, and shall be constructed according to the Standard Details.
g. Drainage inlets and catch basins shall be located as follows:
    i. To assure complete positive drainage of all areas of the development.
    ii. At all low points of streets and rear yards.
    iii. Such that there is no flow across a street intersection.
    iv. Such that there is a maximum of 500 feet of drainage from any particular point in the development to an inlet or catch basin.
h. All pipe connections at manholes shall be separated a minimum 1' between pipe walls with 40% of the manhole circumference intact. The design engineer shall provide details for all manholes with multiple pipe connections not meeting the requirements below:

MANHOLE INSIDE DIAMETER	MAX. PIPE SIZE FOR STRAIGHT-THROUGH INSTALLATION	MAX. PIPE SIZE FOR RIGHT-ANGLE INSTALLATION
48”	24”	18”
60”	36”	24”
72”	42”	36”
96”	60”	42”

i. If the storm sewer will be maintained by a subdivision Home Owners Association (HOA) or Condominium Association (commercial or otherwise), a 12’ minimum easement granted to the respective Association will be required.
j. A two (2) foot sump is required for any structure receiving surface runoff, except inlet structures.
k. All storm sewer shall be “premium joint” (rubber gasket).
l. Trench drains shall be permitted for use in truck wells.

vi. Inlet headwater control or outlet tailwater control nomographs with proper “K” factors shall be used to determine culvert sizes.

VIII. DETENTION/RETENTION BASIN

A. GENERAL

1. All sites will be required to provide a sediment forebay, or equivalent mechanical treatment unit structure within the storm system, at each inlet point to the basin designed to capture the runoff from a 1-year storm.
    a. The forebay should be a separate cell from the main detention/retention basin and designed such that it will dewater within 48 hours. The outlet device must be designed to filter sediment, heavy pollutants and oil from the water flow.
    b. The volume of detention/retention within the forebay, above any proposed permanent pool of water, can be considered when calculating total detention/retention volume required for a site.
    c. The forebay must have a minimum depth of 2 feet to capture and prevent resuspension of sediment. The mechanical system must remove a minimum of 80% of the Total Suspended Solids (TSS) based on a 75-micron particle size and 90% of the floatable free oil and follow the Oakland County Standards.
    d. The separation between the main basin and the forebay shall be designed to allow overtopping of flows in a controlled and non-erosive manner.
    e. An access route shall be provided for forebay/treatment unit maintenance. Direct access shall be provided for the inlet and outlet facilities.
2. Detention volume on a gravity outflow detention basin is defined as the volume of detention provided above the invert of the outflow pipe. Any volume provided below the invert of the outflow pipe will not be considered detention.
3. Detention basin shall be sized to accommodate only on-site drainage and limited off-site drainage if applicable. Off-site drainage shall be routed around the site basin as to “pass-through” the site without affecting the restrictor sizing within the basin outflow structure. Drainage area map shall include all off-site areas per storm sewer requirements.
4. If a wet basin is designed, the minimum average depth of permanent standing water shall be 4 feet. Additionally, some mechanical means for water circulation shall be integrated into the pond to minimize stagnant water.
5. If a dry basin is designed, the bottom shall be sodded. 1.0% is the minimum bottom slope allowed.
6. All basins shall have a positive dewatering method, such as by gravity flow or pump outlet.
7. Minimum 12" freeboard provided (at overflow) above 100-year storm elevation.
8. A proposed non-erodible overflow route must be shown on the plans and must be able to contain a 100-year storm event. Acceptable methods would include a control structure, overflow weir and swale, etc. Downstream drainage easements may be required for the overflow route.
9. The receiving watercourses shall be identified on the plan for the 100-year event.
10. The developer shall make provisions for maintenance of the basin by the property owner(s). The Township will not accept the responsibility for the maintenance of

any basin or other site drainage feature. See Township Ordinance No. 139 for details regarding maintenance responsibilities.

11. Basins bank slopes shall be fenced if side slopes exceed 1 on 4 (may be waived if Bldg. Dept. feels location and depth do not present a hazard and/or design is integral part of landscaping). Wet basin side slopes may not exceed 1 on 6 at the normal water level. Also applies to sediment basins.
    a. If a fence is required an access gate shall be provided, as approved by the Township.
    b. Maximum side slope 1 on 3. Properly designed retaining walls may be utilized on any or all sides of a proposed basin. See Section XI "Retaining Walls" for wall requirements.

B. <u>DESIGN CRITERIA</u>

1. Oversize storm pipes or underground basin (with restricted outlet) may be allowed, subject to Township review.
2. No rooftop or parking lot detention/retention is allowed.
3. Restricted outflow shall be 0.2 cfs/acre unless otherwise allowed/required by design of receiving drain. Note: Some areas in Orion Township require a more restrictive runoff rate. See *Appendix F* for a listing of allowable discharge rates for drainage districts within the Township or contact OCWRC.
4. Provide calculations showing the required restrictor size to control the rate of outflow. The minimum restrictor size is three (3) inches in diameter.
5. Sediment forebays shall be sized to handle the runoff generated by all improved site area during a 1-year storm event, based on Oakland County Simplified Method. Volume calculations must be provided for each contributing area. See *Appendix F* for a sample calculation.
6. Detention basins shall be sized to handle the runoff generated by all improved site area during a 100-year storm event, based on Oakland County Simplified Method. Calculations for storage (both required and provided) and orifice sizing must be shown on the plans. See *Appendix F* for a sample calculation.
7. Retention basins shall be sized to handle the runoff generated by all improved site area for two (2) consecutive 100-year storm events, using Oakland County Simplified Method. See *Appendix F* for a sample calculation.
8. Both in-line and off-line detention will be considered. An in-line detention outlet must control the runoff from the 100-year storm event, including upstream drainage.
9. Underground storage facilities will be considered where traditional storm water management measures are not feasible. The use of underground storage will require the installation of one of two recommended control structure. The first is a standard manhole with weir plate (top of plate at 100-year storm elevation) and orifice provided for 1-year allowable discharge; this configuration can only be used in a pre-cast manhole. The second is a corrugated metal standpipe strapped inside in a minimum 5' diameter manhole (top of standpipe at 100-year storm elevation) and an orifice drilled into the standpipe to allow the discharge of the 1-year storm event.
10. Detention in wetlands may be allowed, subject to Township/MDEQ review. Conditions that must be met for Township approval are outlined in Ordinance No.

139. The permitted use of the wetlands for storm water discharge and/or detention shall not exempt the wetlands from future regulation or consideration as a wetland with respect to the Goemaere-Anderson Wetland Act. (Part 303 of Act 451 of P.A. 1994)

11. Overflow outlet shall be the standard OCWRC standpipe with 1-year and 100-year outflow provision. Both the 1-year and 100-year structures should be permanent. See *Appendix F* for a copy of the OCWRC detail.
12. Outlet pipe from 100-year overflow to receiving system shall be sized for 10-year storm.

C. WATER QUALITY ALTERNATIVES

1. The above storm water standards represent the minimum criteria that are necessary in order to gain approval. The Township would like to encourage developers and engineers to utilize alternate approaches to site construction that improve storm water quality and reduce the quantity of runoff from the site. In order for the Township to consider alternate designs, documentation must be provided that presents the alternate's sustainability and long term maintenance requirements. The following list is a partial list of Best Management Practices (BMPs):
    a. Green Roofs
    b. Bioswales
    c. Cisterns
    d. Rain Gardens
    e. Porous Pavement
    f. Native Landscaping
    g. Filter Strips
    h. French Drains
    i. Level Spreaders
    j. Dry wells

VIII. FLOOD PLAIN DEVELOPMENT

A. GENERAL

1. MDEQ permit required.
2. Review per principles of compensating excavation (i.e., all fill within floodplain must be compensated for by an equivalent volume of excavation to maintain water storage volume).
3. 100-year flood plain (per FEMA) must be shown on all plans. If no flood plain exists, so note.

IX. SITE GRADING

A. GENERAL

1. Sufficient proposed grades indicated to ensure that:
    a. Drainage is adequately discharged offsite with proper detention or retention.
    b. No upstream drainage is restricted.
    c. Paving slopes are adequate.
    d. The site generally drains without standing water.
    e. Sight lines are not obstructed (especially at driveways).
2. Elevations representing the finished grade and the first floor grade must be indicated for both proposed buildings and existing buildings on adjacent property.
3. No disturbance shall be permitted to vegetation and no activity shall be permitted within twenty-five (25) feet of a regulated wetland or watercourse in all zoning districts. This provision is not intended to prohibit wetland crossings for infrastructure or wetland fill approved by either the Charter Township of Orion or Michigan Department of Environmental Quality.
4. Proposed grading shall meet abutting property line elevations. Easements from adjacent property owners will be required for any offsite grading.
5. Differentials in grade must incorporate a 4 on 1 maximum slope to the abutting property line.
6. If permitted by the Township Engineer, slopes of 3 on 1 to 4 on 1 can be constructed interior to the site and shall be restored using an approved "erosion blanket". This shall be identified on the plans. Non-vegetative restoration may also be considered for these slopes, if permitted.
7. Walls or berms, as required by Zoning, must be shown in cross-section and included in the bound engineering plan set. Walls separating a grade differential of more than 3' are considered retaining walls and require a structural engineering design and review. Some retaining walls less than 3’ in height, if determined by the Township, will require structural design and review. Design Engineer must supply calculations and include all retaining walls in the Engineer's estimate.

XI. RETAINING WALLS

A. GENERAL

1. Design details and computations (sealed by a registered engineer in good standing in the State of Michigan) shall be submitted and approved for all retaining or screen walls which are greater than three (3) feet in height. The Township reserves the right to require design calculations and details for shorter walls in unique situations. Cost of wall shall be included in engineer's estimate submitted with Engineering Plan Review application.
2. Any face of a retaining wall shall be a minimum of five (5) feet from the nearest property line as to provide adequate space for maintenance and potential drainage swales if required.
3. Easement from abutting parcels will be required for any retaining wall footing that encroaches on said parcel, or where it appears that "normal" (1 on 1 side slope) excavation to the bottom of the footing would require encroachment.
4. Typically, utilities shall not be proposed under a retaining wall. If it is unavoidable, then all proposed utilities shall be installed in a proper casing pipe.
5. Wall details shall be included in the overall plan set.
6. It is noted that additional surface drainage shall not be placed directly behind the wall upon completion of construction for this may compromise the structural integrity of the wall.
7. Design engineer shall execute and submit certification form. (See *Appendix G* for example form.) Additionally, if the design engineer for the site did not complete the design of the retaining wall, then the retaining wall design engineer shall sign and seal their plans.
8. The following wall types are acceptable in the Township:
    a. Concrete Wall
    b. Pre-Cast Wall
    c. Block Wall
    d. Wood Wall
    e. Boulder Wall
9. The following items shall be included in all retaining wall submittals for review:
    f. Plan View
        i. Clearly identify location of the structure in plan view.
        ii. Indicate the top of wall and bottom of wall elevation at a minimum interval of 25' along the wall.
        iii. Provide finished grades adjacent to the structure at a maximum interval of 25'.
        iv. Show location of protective guardrail and/or fencing. The necessity for guardrail will be reviewed on a case-by-case basis. Typically, a guard, fence or guardrail is required on structures greater than 30" in height. The typical guard or fence is 42" high with openings less than 4" in diameter.
        v. The proposed drainage system shall be shown on the plans as well as its ultimate discharge point, i.e. storm structure, ditch or swale, etc.

g. Cross-section View
   i. Provide minimum and maximum heights of the wall.
   ii. Identify the material type and all manufacturers' specifications.
   iii. State the proposed structural dimensions, including wall thickness, and the depth and thickness of the footing.
   iv. Geo-grid length shall be provided, dimensioned and labeled, as well as the embedment depth. Any changes in layout shall be shown on the plans.
   v. Fence, guard, or guardrail post footings or connections to walls shall be detailed. Installation of the post or post footing shall be specified so as not to damage any geo-grid, if applicable.
   vi. The location of utility crossings shall be noted. Additionally, the manner in which these crossings will be constructed so as not to diminish the integrity of the wall shall be noted.
h. Calculations
   i. Design loads including vehicular impact and surcharge loadings where applicable. Loads due to attached structures (fences, guardrails, guards, etc) shall be considered in the design of the wall.
   ii. Note the grade of reinforcing steel, as well as the cover depth and the horizontal spacing.
   iii. Provide the bearing pressures (noted or referenced) and the soil bearing capacities.
   iv. Provide soil boring information and geotechnical analysis, if required.

XII. SOIL EROSION CONTROL

A. GENERAL

1. All sites with more than an acre of disturbed ground (total) or any earth disruption within five hundred (500) feet of the waters of the state regardless of the amount of land disturbed must apply for a permit from Orion Township. All sites shall conform to the criteria listed herein and within Article 4 of Ordinance 139. Soil Erosion Permits shall not be issued if the required fees and bonds have not been submitted to the Township and will only be issued to the landowner. Additionally, all site plans shall follow the plan requirements pursuant to rule 1703 promulgated under Part 91, as amended.
2. A soil survey or written description of the soils of the anticipated exposed land area shall be included within the plan.
3. All proposed temporary and permanent erosion control measures shall be shown on the plans submitted to the Township. Descriptions for installing and removing all proposed temporary measures shall be included and descriptions for permanent measure installation shall be included.
4. A Soil Erosion Control (and/or construction) Sequence shall be shown on the plans outlining the timing of proposed earth changes.
5. The smallest practical area of land should be exposed at any one time during development. "Practical area" shall be defined as the area in which temporary or permanent restoration can and will be performed within a reasonable period of time, as defined by the Township. Location of the physical limits of disruption shall be called out on the Soil Erosion Plan.
6. When land is exposed during development, the exposure should be kept to the shortest possible period of time, as deemed by the Township.
7. Temporary vegetation or mulching may be required to protect areas exposed during development, particularly if an unexpected erosion problem becomes evident. The developer will be required to assign this activity top priority upon notification by the Township.
8. Sediment basins (debris basins or silt traps) shall be installed and maintained during construction, to remove sediment from runoff from land undergoing development.
9. Sediment basins (debris basins or silt traps) prior to discharge into any wetland, stream, pond, etc., require 1 x 3 stone outlet filter at all low points/discharge points properly toed into silt fence.
10. The permanent vegetation and structures/basins should be installed as soon as practical during development. This would be included in the Soil Erosion Control Sequence noted above.
11. Wherever feasible, natural vegetation should be retained and protected.
12. All new or existing (disrupted) ditches shall be sodded.
13. Seed and mulch is not permitted on slopes greater than 4:1. “Excelsior" Mulch blanket, sod pegged per Township specifications, or approved equal will be required on such slopes.

14. Temporary vegetation and/or mulching shall be placed after mass grading for sites proposing phasing.
15. For sites where grading occurs in areas where the drainage improvements will not immediately follow, such as phased construction, temporary drainage plans for these types of developments shall be provided in addition to soil erosion and sedimentation control plans.
16. Erosion control shall conform to Oakland County SESC standard details, with a detail of each measure used required to be shown on the plans.
17. The developer shall clean all structures impacted during construction along with any other erosion control items prior to occupancy.

XIII. PAVING IMPROVEMENTS

A. GENERAL

1. On-site Paving Requirements:
   a. Pavement cross-section must be shown on the site plan as well as the site improvement plan. All driveway cross-sections shall meet or exceed the cross-section of the roadway it enters onto. On-site minimums are:
      i. Residential, Commercial, and Multiple Residential (SF, SE, SR, R1-R3, MHP, OP, GB, RB, RM1, RM2): 4" asphalt on 8" aggregate base or 7" concrete on approved base.
      ii. Light Industrial (LI): 6" asphalt on 8" aggregate base or 8" concrete on approved base.
      iii. Industrial (IP, IC, RFY): 9" asphalt or 9" concrete on approved base.
      iv. Loading zones and dumpster pads: 8” non-reinforced concrete on approved base.

      NOTE: Requirements are typical for areas zoned industrial, technology and research, or office, and may be modified based on Township review. Requirements for areas zoned SP and P will be based on Township review.
   b. Minimum slope:
      i. Asphalt: 1.0%
      ii. Concrete: 0.4%
   c. Maximum slope
      i. Roads: 6.0%
      ii. Parking: 4.0%
      iii. Sidewalks & Pathway: 5.0%
      iv. Accessible parking spaces (per ADA requirements and MDOT, where applicable) and access aisles shall be level with surface slopes not exceeding 2.0% in all directions.
   d. Minimum drive & greenbelt widths and parking lot dimensions to be in accordance with Charter Township of Orion Zoning Ordinance No. 78. The ordinance text can be viewed on the Ordinance website.
   e. Curb and gutter is required at edge of drives and parking aisles unless otherwise approved by the Township.

f. Concrete curb and gutter sections shall meet requirements M.D.O.T. Specifications Section 802.

2. All roads shall have 6” edge drain with pea stone and filter fabric provided on both sides of the road for its entire length. The Township will not allow any road lacking edge drain. Unless a geotechnical report is presented by the developer that states underdrain is not necessary.

B. PUBLIC RIGHT-OF-WAY

1. All roads shall follow the appropriate standards for the owner of said corridor (i.e. Road Commission for Oakland County or Michigan Department of Transportation).

C. RECREATIONAL PATHWAYS AND SIDEWALKS

1. Sidewalk or recreational pathway required along the frontage of all major roads. Reference Township Ordinance No. 97 for Safety Path Regulation.
2. Located 1' from ultimate ROW line unless otherwise approved. Path can be constructed on private property if easement is dedicated to the Township.
3. Concrete sidewalk: minimum 5' wide, 4" minimum thickness with 8"minimum thickness at driveways for major roads/major driveways and 6" minimum thickness at driveways for collector roads and commercial driveways. Base to be 4" as noted below in item 8.
4. Recreational Pathway: minimum 8' wide, 3" minimum thickness over a 4” aggregate base of 21AA or as approved by the Township Engineer. Existing subgrade must be compacted and treated with soil sterilant.
5. Proposed grades shall be given at property corners, driveways and intermittent locations between.
6. Handicapped ramps shall be noted and an acceptable detail provided for a detectable warning (per ADA requirements and MDOT, where applicable). All areas where the pathway/sidewalk intersects the curb will require a handicapped ramp. The MDOT Sidewalk Ramp Detail can be found on the MDOT website. The detectable warning shall be specified as Vitrified Polymer Composite cast-in-place tile, whose color shall be “Brick Red” (Federal Color No. 20109). Detectable warning surfaces are only required at roadway crossings, not driveway crossings. All sidewalk construction shall be in accordance with the Americans with Disabilities Act of 1990, as amended.
7. All fixed objects: structures, hydrants, poles, etc., shall be noted and moved to a minimum clearance of 3-feet for separation, or adjusted as necessary, from the edge of the pathway. A minimum clearance of 5 feet is required from the back of curb, 8.5-feet overhead clearance, and 12-feet minimum clearance required from edge of the travelled way (designated by a white line, no curb).
8. A minimum 4" aggregate base (MDOT 21AA) or suitable Class II base (approved by the Township) shall be required for all sidewalks and a minimum 4" aggregate base (MDOT 21AA) for all recreational pathways. Pramitol "25E" or approved equal soil sterilant shall be placed on the subbase prior to paving. (Note:

crystalline form placed immediately prior to paving is recommended, to minimize sterilant migration from the path).

9. The cross slope gradient for drainage shall be less than 2%.
10. The longitudinal grade of the path shall not exceed 5%.
11. All sidewalk or recreational pathways shall attempt to perpendicularly intersect drives, railroads, roadways, etc.

D. PRIVATE ROADS

1. Private roads for residential development should follow the subdivision asphalt paving detail cross section provided in Appendix G.
2. All private roads shall have a minimum ROW per Township Ordinance 60, with any additional width as required by the Township. Minimum ROW for business and industrial private roads (all non-residential zoning) shall be a minimum of 70 foot ROW, with any residential collectors to be a minimum of 86 feet of ROW.
3. Where Township maintained utilities are placed in private roads, exclusive easement(s) rights shall be granted to the Township. Recorded documents shall be provided prior to acceptance, use, or occupancy.

E. PAVEMENT CONSTRUCTION REQUIREMENTS

1. All paving geometry should follow the requirements set by the Road Commission of Oakland County (RCOC).

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APPENDIX A

GENERAL LIABILITY INSURANCE FORM

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YY)

PRODUCER

YOUR INSURANCE COMPANY

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERS AFFORDING COVERAGE	NAIC #
INSURER A:	
INSURER B:	
INSURER C:	
INSURER D:	

INSURED

CONTRACTOR

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF THE INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAME ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

R LT	D'L INS	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
A		**GENERAL LIABILITY**				EACH OCCURRENCE	$ 3,000,000
		X COMMERCIAL GENERAL LIABILITY				DAMAGE TO RENTED PREMISES (Ea occurrence)	$
		CLAIMS MADE X OCCUR				MED EXP (Any one person)	$
						PERSONAL & ADV INJURY	$
		GEN'L AGGREGATE LIMIT APPLIES PER:				GENERAL AGGREGATE	$ 3,000,000
		POLICY PROJECT				PRODUCTS - COMP/OP AGG	$
A		**AUTOMOBILE LIABILITY**				COMBINED SINGLE LIMIT (Ea accident)	$ 2,000,000
		X ANY AUTO					
		ALL OWNED AUTOS				BODILY INJURY (Per person)	$ 500,000
		SCHEDULED AUTOS					
		HIRED AUTOS				BODILY INJURY (Per accident)	$ 500,000
		NON-OWNED AUTOS					
						PROPERTY DAMAGE (Per accident)	$ 500,000
		GARAGE LIABILITY				AUTO ONLY - EA ACCIDENT	$
		ANY AUTO				OTHER THAN EA ACC	$
						AUTO ONLY AGG	$
A		**EXCESS/UMBRELLA LIABILITY**				EACH OCCURRENCE	$
		OCCUR CLAIMS MADE				AGGREGATE	$
							$
		DEDUCTIBLE					$
		RETENTION					$
A		**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY**				WC SATUTORY LIMITS	
						OTHER	
		ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED?				E.L. EACH ACCIDENT	$
		If yes, describe under				E.L. DISEASE - EA EMPLOYEE	$
		SPECIAL PROVISIONS below				E.L. DISEASE - POLICY LIMIT	$
B		**OTHER**					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

LIST PROJECT NAME, ENDORSE AS ADDITIONALLY INSURED: ORCHARD, HILTZ & McCLIMENT, INC., ORION TOWNSHIP
Attach the endorsement for additionally insured parties to the insurance certificate

CERTIFICATE HOLDER

OWNER/DEVELOPER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, ~~BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OF LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.~~

AUTHORIZED REPRESENTATIVE

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED - DESIGNATED PERSON OR ORGANIZATION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name of Person or Organization:

Charter Township of Orion
OHM-Advisors

A. SECTION II - WHO IS AN INSURED is amended to include as an insured the person or organization shown in the Schedule but only with respect to liability arising out of your operations or premises owned by or rented to you.

B. The following exclusion is added to SECTION I - COVERAGES, COVERAGE A. BODILY INJURY AND PROPERTY DAMAGE LIABILITY, 2. Exclusions and SECTION I - COVERAGES, COVERAGE B. PERSONAL AND ADVERTISING INJURY LIABILITY, 2. Exclusions:

The insurance provided to the additional insured does not apply to "bodily injury", "property damage" or "personal and advertising injury" arising out of the sole negligence or willful misconduct of, or for defects in design furnished by, the additional insured or its "employees".

C. SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS. 5. Other Insurance is amended to include:

Any insurance provided by this endorsement shall be primary to other insurance available to the additional insured except:

a. As otherwise provided in SECTION IV - COMMERCIAL GENERAL LIABILITY CONDITIONS, 5. other Insurance; or

b. For any other valid and collectible insurance available to the additional insured as an additional insured by attachment of an endorsement to another insurance policy that is written on an excess basis. In such case, the coverage provided under this endorsement shall also be excess.

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APPENDIX B

INSPECTION ESCROW/
MAINTENANCE & GUARANTEE BOND

BASIS FOR CALCULATING INSPECTION ESCROW AND MAINTENANCE & GUARANTEE BOND

Escrow charges will cover costs associated with the pre-construction meeting, full-time inspection, field engineering due to change requests from approved plans, witnessing of water main pressure test and sanitary sewer air test (if applicable), final site inspection, reviewing of "Record Drawings" and any public sewer or water main easements, and inspection administration. This money will be placed in an escrow account and any unused funds will be refunded. If the estimated amount is not sufficient to cover the project inspection costs, an additional fee shall be required prior to acceptance by the Township.

A Maintenance & Guarantee Bond for 25% of the engineer's estimate of all public improvements will be required prior to acceptance by the Township.

The following is a summary of the items that will be included when calculating the Inspection Escrow and the Maintenance & Guarantee Bond. Please note that some sites may step out of the boundaries herein and will need to be treated uniquely.

A. <u>INSPECTION ESCROW</u>

- Water Main
- Sanitary Sewer
- Storm Sewer
- Grading
- Pathway Inspection

B. <u>MAINTENANCE & GUARANTEE BOND</u>

- Public Water Main
- Public Sanitary
- Public Pathway

Prior to construction, a pre-construction meeting will be held. The developer will be required to post the estimated inspection escrow prior to scheduling this meeting.

MAINTENANCE AND GUARANTEE BOND

Obligee Review or Project No._____ Bond No._____
(if applicable)

KNOW ALL MEN BY THESE PRESENTS:

That we, the developer, _____ (hereinafter called Principal), and _____ (hereinafter called Surety), a corporation organized under the laws of the State of _____ and authorized to do a surety business in the State of Michigan, are held and firmly bound unto the municipal agency known as the Charter Township of Orion (hereinafter called Obligee) in the full and just sum of _____ Dollars and _____ Cents ($_____), lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has constructed or caused to have constructed the following described public improvements in a public easement and/or right-of-way:

(Check all applicable items)

_____Storm Sewer System _____Roadway
_____Sanitary Sewer System _____Sidewalk
_____Water Main System _____Other: _____

which have been or are about to be accepted by the Obligee for the project known as _____ _____and located in Section _____, T_____, and R_____; more specifically at _____.

AND WHEREAS, it is required that the Principal should guarantee the project from defects caused by faulty materials or workmanship for a period of 2 year(s) from and after the date of acceptance of same by the Obligee.

The Obligee shall notify the Principal in writing of any defect for which the Principal is responsible and shall specify in said notice a reasonable period of time within which the Principal shall have to correct said defect. If the Principal fails to correct such defect within the time specified in said notice, then the Surety shall have sixty (60) days thereafter within which to take such action as it deems necessary to insure performance of the Principal's obligation. If such defect is not corrected after the expiration of such sixty-day period, then the Obligee shall have the right to correct such defect and the Principal and Surety, jointly and severally, shall pay all costs and expenses incurred by Obligee in correcting such defect; including but not limited to, the engineering, legal, administration and other costs, together with any damages either direct or consequential, which the Obligee may sustain on account of the Principal's failure to correct such defect. In addition, the Obligee shall have the right to contract for the correction of such defect and, upon acceptance of the lowest responsible bid, the Principal and Surety shall become immediately liable for the amount of the said bid.

If any repair is necessary to be made at once to protect life and property, then and in that case, the Obligee may take immediate steps to repair or barricade such defects without notice to the Principal or Surety. In such accounting, the Obligee shall not be held to obtain the lowest figures for the doing of the work, or any part thereof, but all sums actually paid therefore shall be charged to the Principal or Surety. In this instance, the judgment of the Obligee is final and conclusive.

The Principal shall fully indemnify, defend and save harmless the Obligee, and its agents, consultants, employees and officers from all suits and actions for damages of every name and description brought or claimed against them for, or on account of, any injury or damage to person or property received or sustained by any party or parties, by or from any of the acts or omissions or through the negligence of said Principal, and its servants, agents or employees, in the prosecution of the work, and from any and all claims arising under the Workman's Compensation Act, so-called, of the State of Michigan.

NOW, THEREFORE, if the said Principal shall for a period of 2 year(s) from and after the date of acceptance of the completed project by the Obligee replace any and all defects arising in said work whether resulting from defective materials or defective workmanship, then the above obligation shall be null and void; otherwise to remain in full force and effect for 2 year(s) from the date of acceptance by the Obligee.

IN WITNESS WHEREOF, the parties have caused this instrument to be signed and sealed by their respective authorized officers this_____day of_____,20___.

WITNESS

_____

Name:_____

PRINCIPAL

_____
(seal)

By:_____

Name:_____

Title:_____

Address:_____

_____

Phone:_____

Fax:_____

SURETY

_____
(seal)

By:_____

Name:_____

Title:_____

Address:_____

_____

Phone:_____

Fax:_____

_____

Name:_____

APPENDIX C

THE CHARTER TOWNSHIP OF ORION STANDARD NOTES & FIRE DEPARTMENT NOTES

CHARTER TOWNSHIP OF ORION STANDARD NOTES

CONSTRUCTION SHALL CONFORM TO CURRENT CHARTER TOWNSHIP OF ORION STANDARDS.

NO SITE WORK SHALL OCCUR WHATSOEVER UNTIL THE SITE PLAN AND ENGINEERING PLAN HAVE BEEN APPROVED, ALL FEES HAVE BEEN PAID TO THE TOWNSHIP, AND THE PRE-CONSTRUCTION MEETING HAS BEEN HELD. IT SHALL ALSO BE NOTED THAT NO WORK SHALL BE PERFORMED WITHOUT INSPECTION.

ALL STREETS MUST BE MAINTAINED DURING CONSTRUCTION. STREETS SHALL BE KEPT FREE OF MUD, DIRT, CONSTRUCTION DEBRIS, DUST AND THE LIKE.

WORKING HOURS (INCLUDING RUNNING OF ANY MACHINERY) SHALL BE RESTRICTED TO MONDAY THROUGH SATURDAY, 7:00 AM TO 7:00 PM; SUNUP TO SUNDOWN; WHICHEVER IS LESS. CONSTRUCTION OPERATIONS BEYOND THE PERIODS MENTIONED ABOVE SHALL BE PERMITTED ONLY AFTER WRITTEN APPROVAL OF THE TOWNSHIP SUPERVISOR OR THEIR DESIGNEE. PLEASE REFER TO ORDINANCE 135 (NOISE ORIDINANCE) FOR ORION TOWNSHIP TO OBTAIN ADDITIONAL REQUIREMENTS FOR NOISE RESTRICTIONS.

ALL MATERIALS AND MANUFACTURERS SHALL CONFORM TO THE STANDARD DETAILS.

UTILITY STRUCTURES SHALL NOT BE LOCATED IN DRIVEWAYS, AND WHERE POSSIBLE, SHALL NOT BE LOCATED IN PAVED AREAS.

THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES IN ACCORDANCE WITH ACT 53 OF PUBLIC ACT 174 OF 2013 AND ALSO CONTACT OAKLAND COUNTY UTILITY AND PROTECTION SERVICE (MISS DIG 1-800-482-7171) THREE (3) WORKING DAYS BEFORE THE START OF ANY CONSTRUCTION.

THE CONTRACTOR SHALL PROVIDE NECESSARY SIGNS, BARRICADES AND LIGHTS TO PROTECT TRAFFIC AND THE WORK AS DIRECTED BY THE ENGINEER. SUCH DEVICES SHALL BE PLACED PRIOR TO STARTING WORK IN AFFECTED AREAS.

PER INTERNATIONAL FIRE CODE 3310 - ACCESS FOR FIRE FIGHTING: APPROVED VEHICLE ACCESS FOR FIREFIGHTING SHALL BE PROVIDED TO ALL CONSTRUCTION OR DEMOLITION SITES. VEHICLE ACCESS SHALL BE PROVIDED TO WITHIN 100 FEET OF THE TEMPORARY OR PERMANENT FIRE DEPARTMENT CONNECTION. VEHICLE ACCESS SHALL BE PROVIDED BY EITHER TEMPORARY OR PERMANENT ROADS, CAPABLE OF SUPPORTING VEHICLE LOADING UNDER ALL WEATHER CONDITIONS. VEHICLE ACCESS SHALL BE MAINTAINED UNTIL PERMANENT FIRE APPARATUS ROADS ARE AVAILABLE.

ALL SOIL EROSION AND SEDIMENTATION CONTROLS SHALL BE IN ACCORDANCE WITH THE OAKLAND COUNTY STANDARDS AND DETAILS. THE CONTRACTOR SHALL FOLLOW LOCAL RULES AND REGULATIONS FOR SOIL EROSION AND SEDIMENTATION CONTROL FOR ALL MATERIALS THAT ARE DISPOSED OF OFF OF THE PROJECT SITE.

ALL SOIL EROSION MEASURES MUST BE PROPERLY PLACED PRIOR TO GRADING OR OTHER CONSTRUCTION ACTIVITIES.

FIELD CHANGES TO THE APPROVED PLAN SHALL BE BROUGHT TO THE ATTENTION OF THE INSPECTOR ON SITE, WHO WILL DETERMINE WHETHER THE CHANGE IS CONSIDERED "SIGNIFICANT". "SIGNIFICANT" FIELD CHANGES SHALL BE SUBMITTED TO THE TOWNSHIP BY THE DESIGN ENGINEER. THE TOWNSHIP SHALL NOT BE HELD RESPONSIBLE FOR DELAYS IN APPROVAL OF CHANGES TO THE APPROVED SITE IMPROVEMENT (ENGINEERING) PLAN.

WHERE POSSIBLE, PUBLIC UTILITIES SHALL NOT BE PLACED UNDER PAVEMENT. THE CHARTER TOWNSHIP OF ORION SHALL NOT BE RESPONSIBLE FOR PAVEMENT, CURB, OR OTHER RESTORATION OF PERMANENT FACILITIES LOCATED WITHIN THE MUNICIPAL EASEMENT.

3 WORKING DAYS PRIOR TO STARTING CONSTRUCTION, CONTACT THE CONSTRUCTION DEPARTMENT OF ORCHARD, HILTZ & McCLIMENT, INC. AT (734) 466-4539 TO SCHEDULE INSPECTION. OHM SHALL INSPECT ALL SITE IMPROVEMENTS INCLUDING UNDERGROUND UTILITY INSTALLATION, EARTHWORK OPERATIONS, RETAINING WALLS, ALL SIDEWALKS OR SAFETY PATHS IN ANY PUBLIC R.O.W., AND ANY ADDITIONAL ITEMS NOTED DURING REVIEW OR AT THE PRE-CONSTRUCTION MEETING. FINAL OCCUPANCY MAY BE AFFECTED IF PROCEDURES ARE NOT FOLLOWED FOR PROPER INSPECTION.

PERMANENT FACILITIES OF ANY TYPE, INCLUDING BUT NOT LIMITED TO, TREES, LIGHT POLES, DRAINAGE STRUCTURES, SANITARY STRUCTURES, BENCHES, TRASH RECEPTACLES, ETC., WILL NOT BE ALLOWED WITHIN THE INFLUENCE OF THE PUBLIC WATER MAIN OR SANITARY SEWER EASEMENTS.

CHARTER TOWNSHIP OF ORION FIRE DEPARTMENT NOTES

(Contact Robert Smith, Fire Chief – (248) 391-0304, ext. 134)

1. NO PARKING SHALL BE PERMITTED AND/OR NO OBSTRUCTIONS SHALL BE PLACED OR CONSTRUCTED WITHIN FIFTEEN (15) FEET OF ANY FIRE HYDRANT OR FIRE DEPARTMENT CONNECTION, PUBLIC OR PRIVATE.

2. THE FIRE DEPARTMENT CONNECTION MUST BE LOCATED WITHIN ONE HUNDRED (100) FEET OF A FIRE HYDRANT AND WITHIN FIFTY (50) FEET OF A MINIMUM EIGHTEEN (18) FOOT WIDE PAVED DRIVEWAY OR STREET.

3. GAS METERS, PROPANE TANKS, OVERHEAD ELECTRICAL SERVICE, AND TRANSFORMERS MUST NOT BE LOCATED ON THE SAME SIDE OF THE BUILDING OR STRUCTURE AS THE FIRE DEPARTMENT CONNECTION UNLESS A CLEAR DISTANCE OF ONE HUNDRED FIFTY (150) FEET CAN BE MAINTAINED BETWEEN UTILITIES AND THE FIRE DEPARTMENT CONNECTION.

4. ALL DRIVE AREAS MUST BE POSTED AS FIRE LANES WITH UNIFORM SIGNS IN KEEPING WITH THE STANDARD ESTABLISHED IN THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES. SIGNS MUST BE ERECTED ON BOTH SIDES OF THE FIRE LANES WITH SPACING BETWEEN SIGNS NOT TO EXCEED ONE HUNDRED (100) FEET.

5. DESIGNATED EXIT DOORS ONTO DRIVES OR PARKING AREAS MUST BE PROTECTED WITH GUARD POSTS OR PARKING BLOCKS.

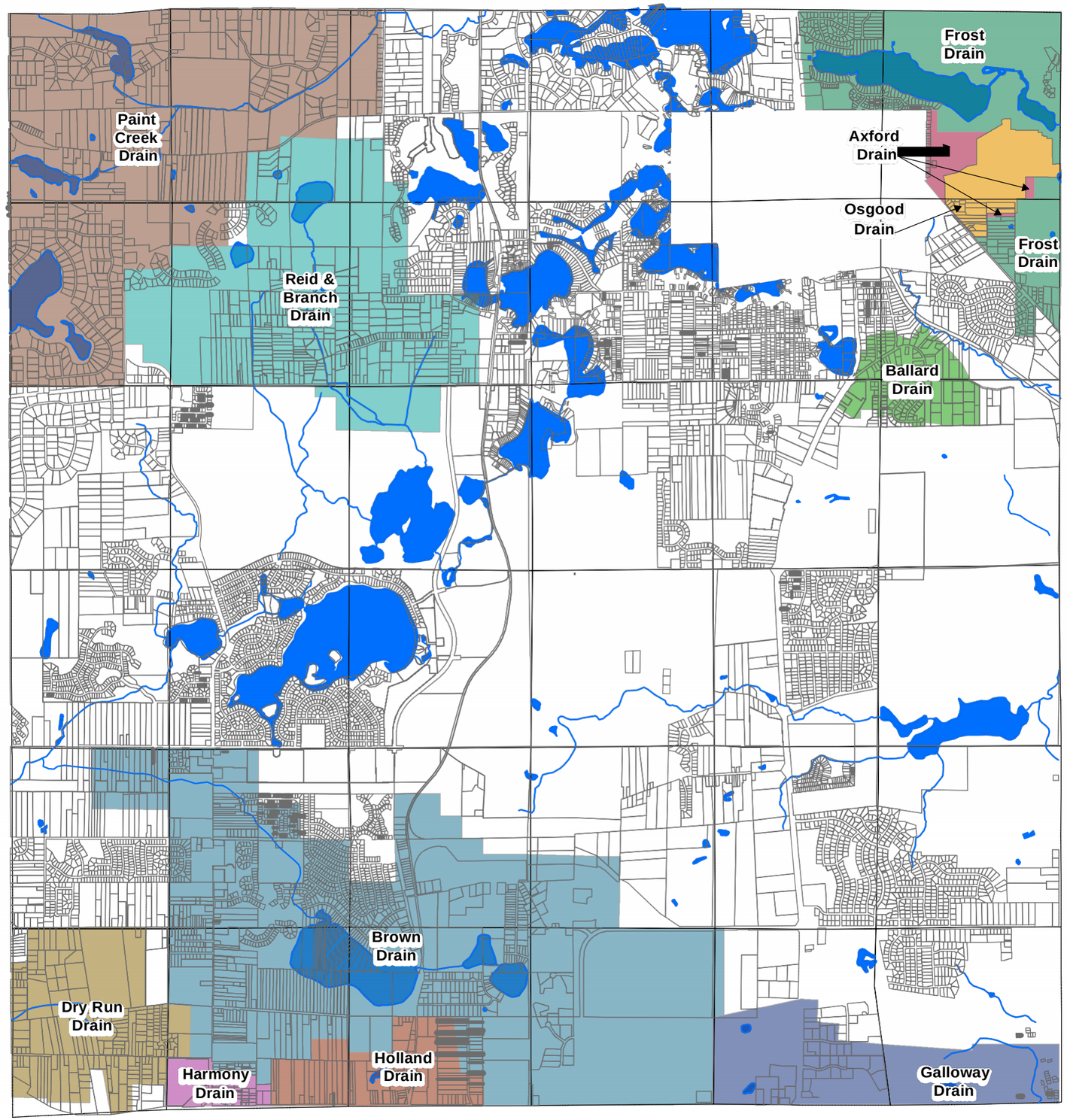
6. A WHITE HIGH VISIBILITY STRIP SHALL BE PAINTED ON THE UPPER FLANGE OF ALL FIRE HYDRANTS.

APPENDIX D

ALLOWABLE DISCHARGE RATES FOR DRAINAGE DISTRICTS IN ORION TOWNSHIP

RETENTION/DETENTION STORAGE VOLUME & ORIFICE SIZING

TYPICAL OCDC STANDPIPE DETAILS



Orion Township Drainage District Map

Legend

Drain Name

- Axford Drain
- Ballard Drain
- Brown Drain
- Dry Run Drain
- Frost Drain
- Galloway Drain
- Harmony Drain
- Holland Drain
- Osgood Drain
- Paint Creek Drain
- Reid & Branch Drain
- Parcels
- Hydrology
- PLSS Sections

0 800 1,600
Feet

1" = 800'

Source: Data provided by Oakland County and Charter Township of Orion. OHM Advisors does not warrant the accuracy of the data and/or the map. This document is intended to depict the approximate spatial location of the mapped features within the Community and all use is strictly at the user's own risk.

Coordinate System: NAD 1983 State Plane Michigan South FIPS 2113 Intl Feet

Map Published: March 10, 2016

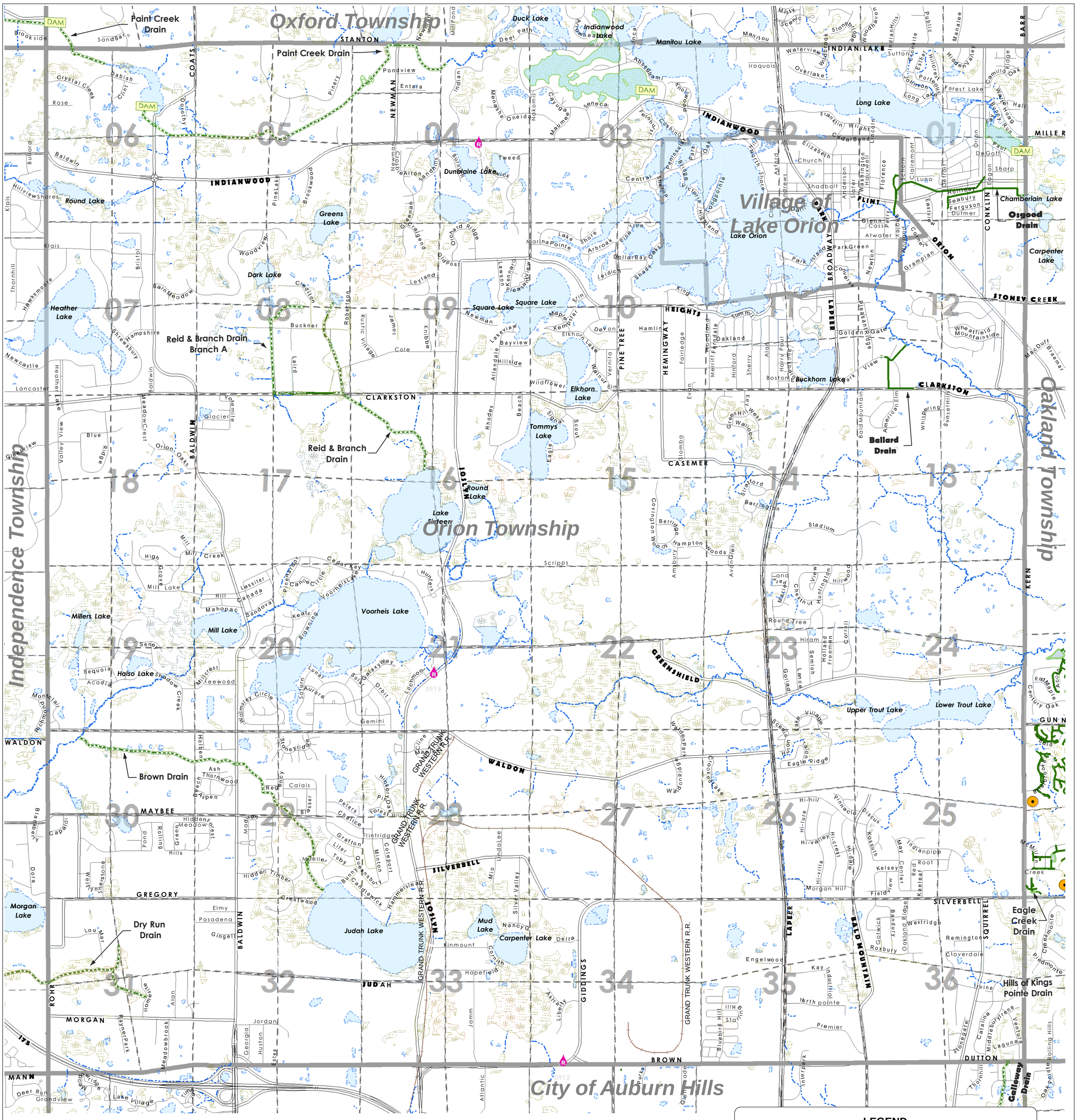
OHM
888.522.6711 | ohm-advisors.com

P:\0101_0125\0121150031_Engineering Standards\Drainage_District Map\Orion_Drainage_District V2.mxd

County Drainage District Restrictions

Drain	Discharge Rate
Axford	0.20 cfs/acre
Ballard	0.20 cfs/acre
Brown	0.10 cfs/acre
Dry Run	0.10 cfs/acre
Frost	0.20 cfs/acre
Galloway	0.097 cfs/acre
Osgood	0.20 cfs/acre
Paint Creek*	0.20 cfs/acre
Reid & Branch	0.20 cfs/acre
Sinking Bridge	0.0776 cfs/acre

**Drainage district combines the previously individual districts of: Cowden, Big Meadows, and Paint Creek*



Orion Township Drains

Maps prepared by:

WRC
WATER RESOURCES COMMISSIONER
Jim Nash

1 Public Works Drive, Bldg 95W
Waterford, Michigan
48328-1907

DISCLAIMER:

The information displayed in this map is compiled from recorded deeds, plats, tax maps, surveys and other public records. Although this information is intended to accurately reflect public information, it is not a legally recorded map or survey and is not intended to be used as one. Users should consult primary/original information sources where appropriate.

N

1 inch = 2000 feet

LEGEND

- Combined Lift Station
- Combined Siphon Structure
- Combined Retention Treatment Basin
- Combined Flow Regulator
- Combined Sewer Vault
- Combined Retention/Detention Vault/Basin
- Combined Large Pipe
- Combined Interceptor
- Combined Siphon
- Drain / Lake Level Lift Station
- Drain Diversion Chamber
- Drain Flow Regulator
- Drain Augmentation Well
- Dam
- Drain Siphon
- Rain Gauge
- MowingSite
- Drain Dike
- Drain Large pipe
- Drain Retention/Detention Vault/Basin
- Drain Storm Pipe
- Drain Storm Culvert
- Drain Siphon
- Drain Force Main
- Drain Channel/Spillway
- Stream / River
- Retention/Detention Basin
- WRC Maintained Lake Level
- Channel
- Lake/Pond or Stream/River
- Swamp / Marsh
- Municipal District

Revision Date: July 27, 2014
J:\Drain\MappingUnit\DRAINS\Index Maps\ORT Drain Index Map.mxd

W1/4 COR. SEC. 1

cENTER OF SEC. 1

LONG LAKE

E.1/4 COR. SEC. 1

BUNNY RUN

BUNNY RUN DAM

SCALE: 1"=200'

NOTES:

FIELD VERIFICATION AND LOCATION OF THE UPPER TERMINUS OF THE AXFORD DRAIN WAS ATTEMPTED ON JANUARY 2, 1991, HOWEVER, NO PHYSICAL EVIDENCE WAS FOUND.

THIS MAP IS A COMPOSITE OF SEVERAL SIDWELL PROPERTY DESCRIPTION MAPS ISSUED IN 1990, COPYRIGHT BY THE OAKLAND CO. PLANNING DIVISION.

THE DRAIN DISTRICT, ROUTE AND OTHER INFORMATION ON THIS MAP HAS BEEN PLOTTED BY VISUAL AND SCALING METHODS FROM EXISTING DRAIN MAPS, OTHER GOVERNMENTAL MAPS, PRIVATE MAPS OR AERIAL PHOTOS AS LISTED.

THE RELATIONSHIP OF THE DRAIN ROUTE AND BOUNDARY TO THE PROPERTIES SHOWN ON THIS MAP ARE FOR GENERAL INFORMATIONAL PURPOSES ONLY. THE EXACT DIMENSIONS OF THE DRAIN ROUTE AND BOUNDARY MAY BE FOUND IN THE LEGAL DRAIN RECORDS.

SE. COR. SEC. 1

DRAINAGE DISTRICT

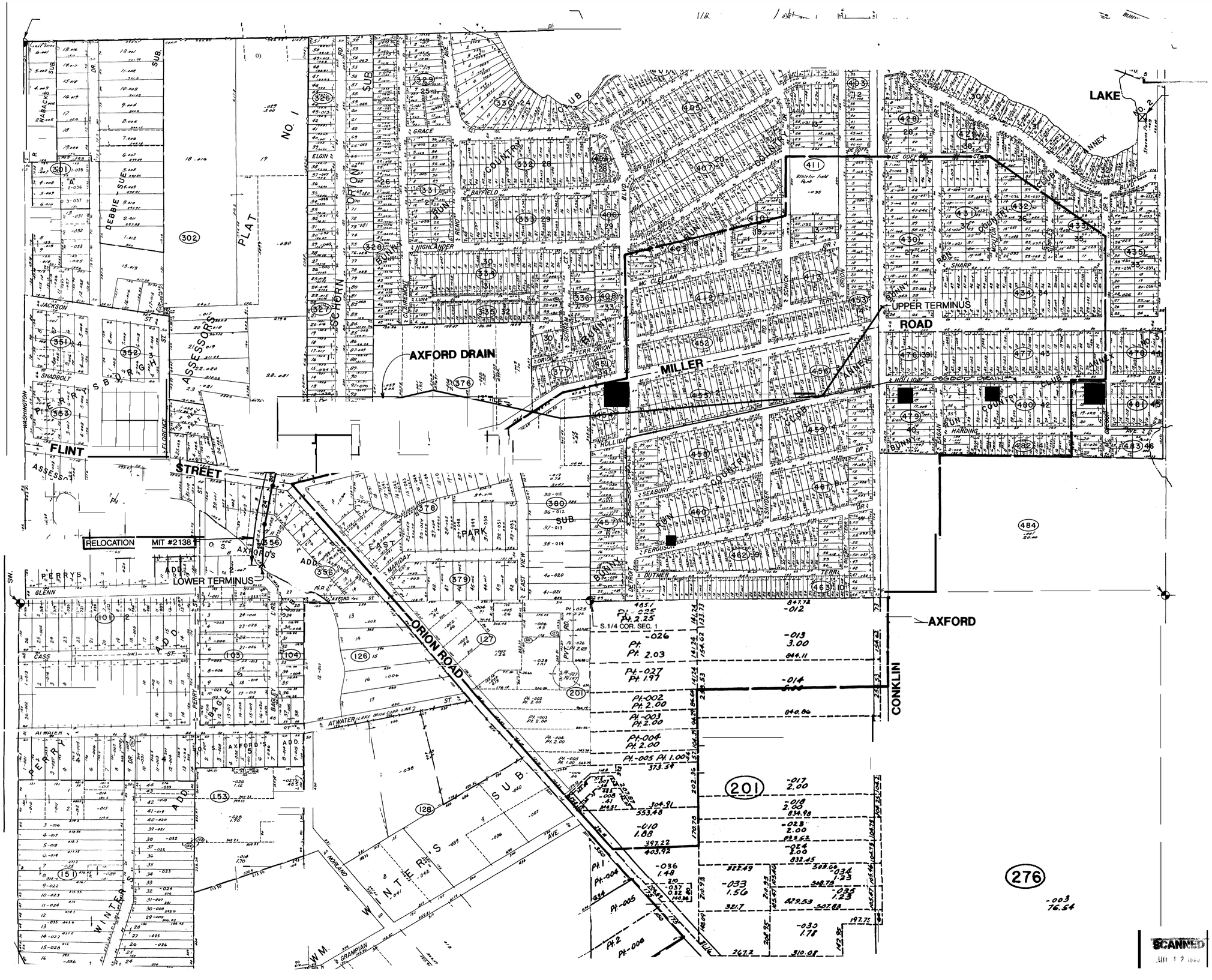
3,9-015

GEORGE W. KUHN
OAKLAND COUNTY DRAIN COMMISSIONER
ONE PUBLIC WORKS DRIVE. WATERFORD. MICHIGAN 4a328-1907

AXFORD DRAIN UPDATE
ORION TOWNSHIP

DRAIN ROUTE AND DISTRICT MAP

DESIGNED BY:	REV.	SHEET NO.
DRAWN BY: K.W.	REV.	
DATE: 12 – 1 '1 – ""X>	REV.	OF


LAKE
UPPER TERMINUS
ROAD
MILLER
AXFORD DRAIN
FLINT
STREET
RELOCATION MIT #2138
LOWER TERMINUS
ORION ROAD
AXFORD
CONKLIN
S.1/4 COR. SEC. 1
ASSESSOR'S PLAT NO. 1
ORION SUB
DEBBIE-SUE SUB.
NABACK SUB
COUNTRY CLUB
LONG LAKE
BAYFIELD
HIGHLANDER
MC CLELLAN
SCHICK
SHARP
HOLLIDAY
HARDING
SEABURY
FERGUSON
DUTMEG
DE GOFF
GRACE
ELGIN
JACKSON
SHADBOLT
FLORENCE
HOLLIDAY
MARIDAY
EAST VIEW
EAST PARK SUB.
PERRYS ADD
GLENN
CASS
ATWATER
AXFORD ADD
WINTERS SUB
WM. GRAMPIAN
276
201
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356
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126
127
128
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484

SCANNED

GOLPE:NGATE

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2.	*976.16*	*£1<.Spike In t4' Ma;:/e 1'1.£. Cor: cS' Nor h Parkvit:W $, !Jo East of Plt:eJ5anf t'dqe.*
3	*"272.37*	*PP. !'pike ;,., 5ouih 5!de of '' Mt/t':/e (:In 11/orth S1d< Rlr viaf. f f We-sf of Pro,.a L tnt::. e' ween*
4,	*977.91*	*Lof. N'o. t.dr;; (of No. 147. R. e 5nfkin /lhrlh 5/de P. P. ll/ · j{.;'rih f of Clarn d 80' #.5 f # t:brt'vt W, Edsl End.*

N /4< CoR.

02JIA

QL.A. O.L.O

"WHITE OAK" SUBDIVISION

6.9 ACRES (more or less) ADDITION
TO DRAINAGE DISTRICT FOR PROPOSED
WHITE OAK SUBDIVISION.

JULY 13, 1993
L. l3821, PP. 167fhrul72.

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As Built Dimensions & Elevations Furnished by the Oakland County Drain Comm.

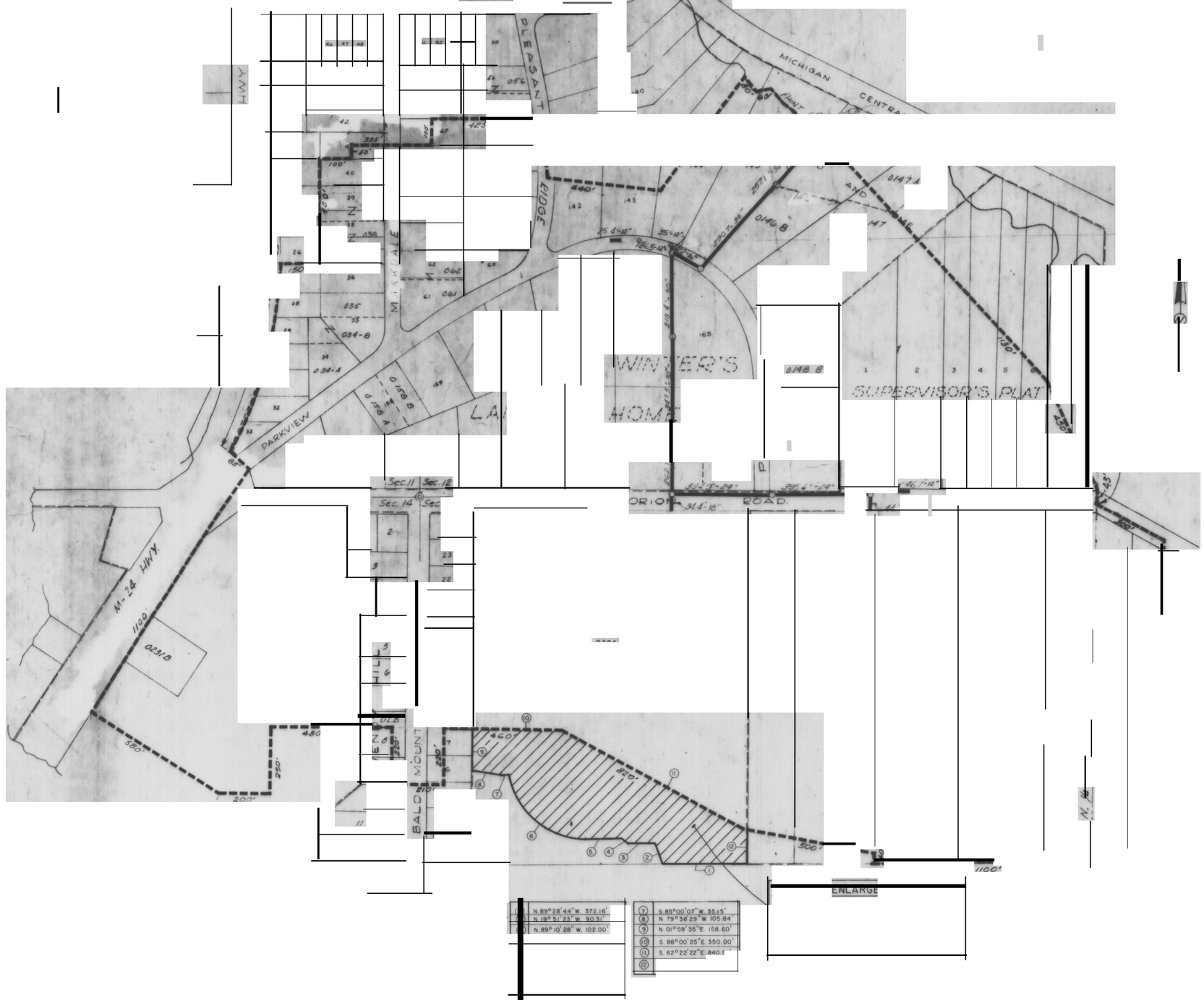
DRAIN COMMISSIONER
OAKLAND COUITY MICHIGAN

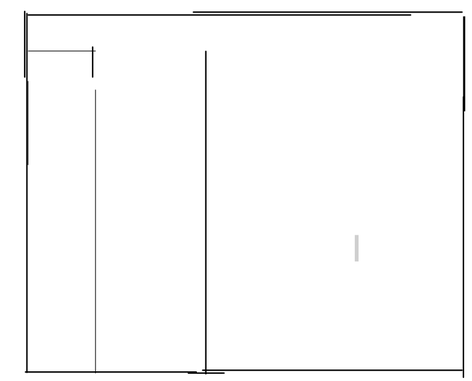
JOHNSON 8t ANDER ON, INC.
CONSULTING ENGINnRS
PONTIAC, MICHI,PAN

BALLARD DRAIN DRI\IHA.I)f TRICT
PARTS " S,SCWJ- (1,t2',1 8 14
ION '·TOWNSHIP

• BALL:-AR{} DRAfN - "
SECTION 12 OF ORION TOWNSHIP'

JOB NO. –/
SHEET NO. /





CLAIR L. JOHNSON
CORNER
No. 3315

REVISIONS	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE
	WJG	As Built 12/1/67							
	G.T.B.	DISTRICT ENLARGEMENT "WHITE CARE" 2/17/72							

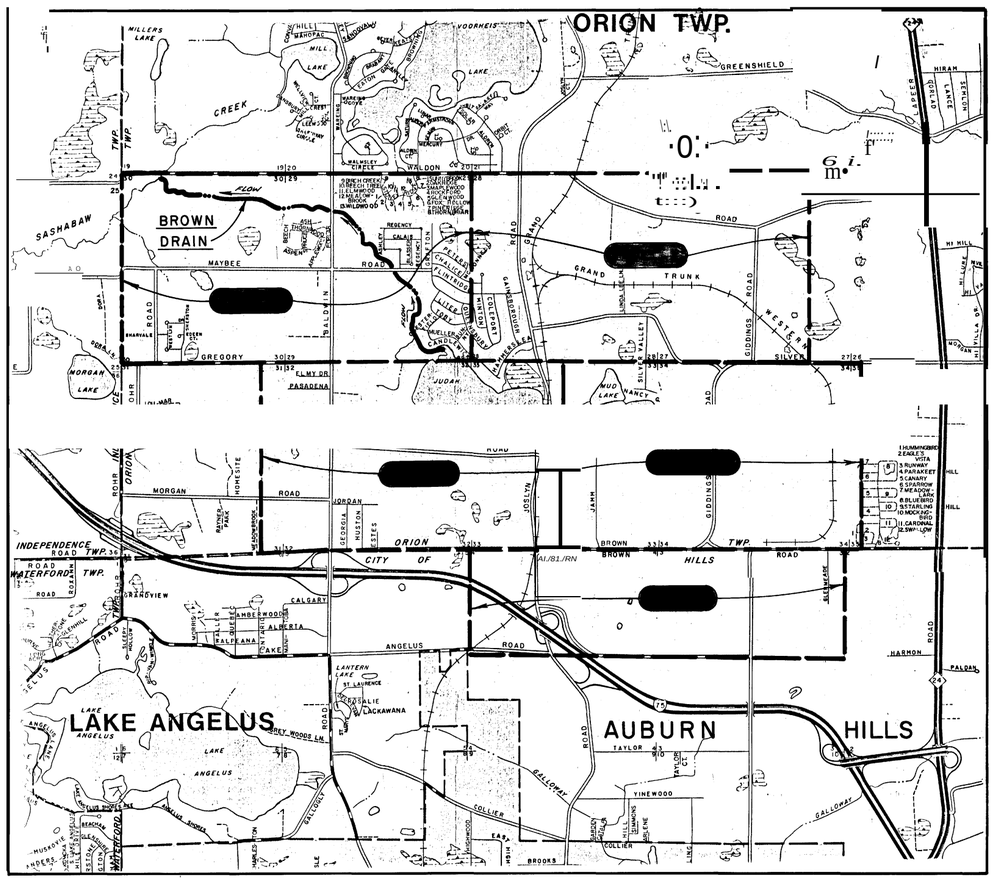
DANIEL W. BARRY

OAKLAND COUNTY MICHIGAN

of 5

BROWN DRAIN

ORION TOWNSHIP AND CITY OF AUBURN HILLS



LOCATION MAP

NORTH

NO SCALE

Taken from Original Records Book 13, Page 105, December 23, 1905

SURVEY OF BROWN DRAIN

Commencing in the center of the Sashabaw Creek (so called) at a point 258.72' South and 1006.50' West of the N.E. corner of the N.W. 1/4 of Sec. 30 in the Township of Orion, County of Oakland; State of Michigan. Thence S. 71° E. 198'; th. S. 37° 45' E. 236.28'; th. S. 83°30' E 287.10'; th. S. 79°E. 409.20' to the East line of said parcel, crossing said line 587.40' South of the N.E. corner thereof.

Thence over and across theW. 1/2 of the N.E. 1/4 Sec. 30 a distance of 1323.96' described as follows: S. 83°30' E. 1323.96' to the East line of said parcel, crossing said line 701.58' South of the N.E. corner thereof.

Thence over and across the E. 1/2 of the N.E. 1/4 of Section 30, a distance of 1386.66', described as follows: S. 88°30' E. 621.72'; th. S 71°E. 157.74'; th. S. 62° E. 318.12'; th. S, 69°45' E. 209.88'; th. N. 81° E. 79.20' to the East line of said parcel, crossing said line 203.28' South of the S.W. corner of the North 23 acres of the W. 1/2 of the N.W. 1/4 of Sec. 29.

Thence over and across the South 57 acres of the W. 1/2 of the N.W. 1/4 Sec. 29, a distance of 1386', described as follows: N. 82° E. 468.60'; th. S. 84° E,122.10'; th. S. 65°30'E. 188.10'; th. N. 72°15' E.201.30'; th. S. 88°15' E. 62.70'; th. S. 72°15° E. 118.80'; th. S. 54°45'E. 161.70'; th. N. 84°30'E, 62.70' to the East line of said parcel, crossing said line 283.80' South of the N.E. corner thereof.

Thence over and across the N.E. 1/4 of the N.W. 1/4 of Sec. 29, a distance of 650.10' described as follows: S, 86°30' E. 261'-At.r the the South line of said parcel, crossing said line 539.88' East of the S.W. corner thereof.

Thence over and across the S.E. 1/4 of the N.W. 1/4 of Sec. 29 a distance of 1445.40' described as follows: Thence S. 52°45' E. 273.90'; th. S. 21°15' E. 184.80'; th. S. 15' E. 231'; th. S. 55" E. 79.20'; th. N. 80°20' E. 105.60'; th. S. 800E. 79.20'; th. S. 60"30' E. 54.78'; th. S. 15°45' E. 258.72'; th. S. 30°30'· E. 82.50'; th. S. 66° E. 95.70' to the East line of said parcel, crossing said line 1007.82' South of the N.E. corner thereof.

Thence over and across theW. 1/2 of the N.E. 1/4 and N.H. 1/4 of S.E. 1/4 of Sec. 29, a distance of 2240.70', described as follows: South 66° E. 168.30'; th. S. 41°30' E. 1417.02'; th. S. 03° E. 450.78'; th. S. 30° W. 99'; th. S. 81°30' W. 102.30'; th. S. 07°30'E. 3.30' to the South line of said parcel, crossing said line 353.10' West of the S.E. corner thereof.

Thence on the S 1/2 of the S.E. 1/4 of Sec. 29, a distance of 1524.60', decribed as follows: South 7°30' E. 145.20'; th. S. 29° W. 105.60'; th. S. 19°15' E. 283.80'; th. S. 49°15' E. 462'; th. S. 60°30' E. 158.40'; th. N. 82°30'E. 369.60' to the outlet of Lake Judah. Said lake being located in the S.E. 1/4 of Sec. 29, N.E. 1/4 Sec. 32, & N.W. 1/4 of Sec. 33 of Orion Township.

SCANNED
JUI 1 !lt

NOTE: ASSESSMENT DISTRICT WAS TAKEN FROM ORIGINAL RECORDS...
BOOK 13, PAGES 114 a 115. ALSO
BOOK 13, PAGES 130, 131, a 132.

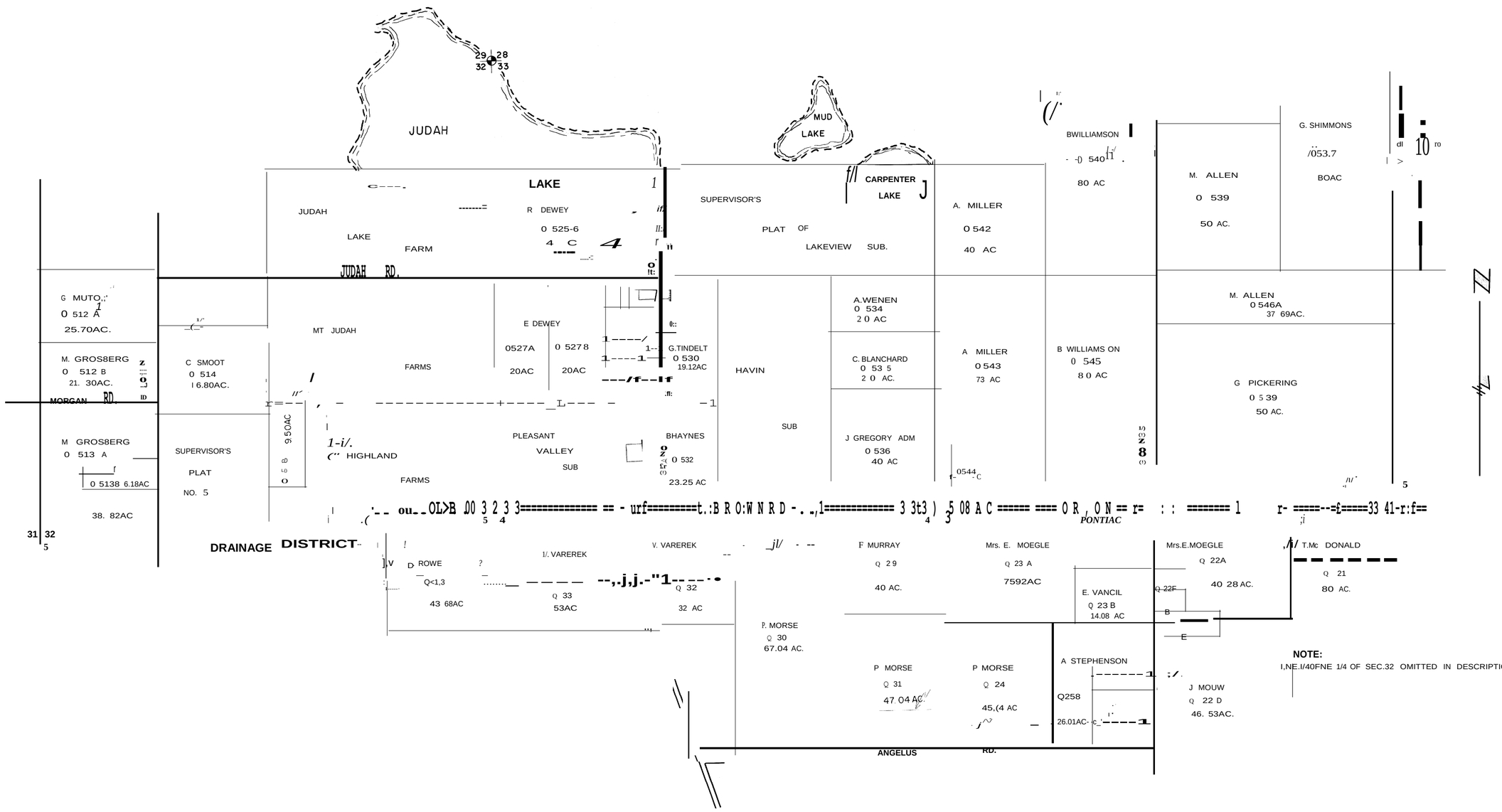
GEORGE W. KUHN
OAKLAND COUNTY DRAIN COMMISSIONER
ONE PUBLIC WORKS DRIVE PONTIAC MICHIGAN 480 4

BROWN DRAIN UPDATE

ORION TOWNSHIP AND CITY OF AUBURN HILLS

DRAIN ROUTE and DISTRICT MAP

SCALE: NO SCALE	REV.	SHEET NO. 1 OF 6
DRAWN BY: G.J.B	REV.	
DATE: 9-5-89		



AS BUILT- DRAWN AUGUST 1959

DANIEL W. BARRY
DRAIN COMMISSIONER
OAKLAND COUNTY, MICHIGAN

Designed By —
Cheeked BY ---
Drawn By G J. M.
Horz. Scale 1"=600'

Field Books

BROWN DRAIN

ORION 8 PONTIAC TWPS.

APPROVED BY _____

REGISTERED PROFESSIONAL ENGINEER

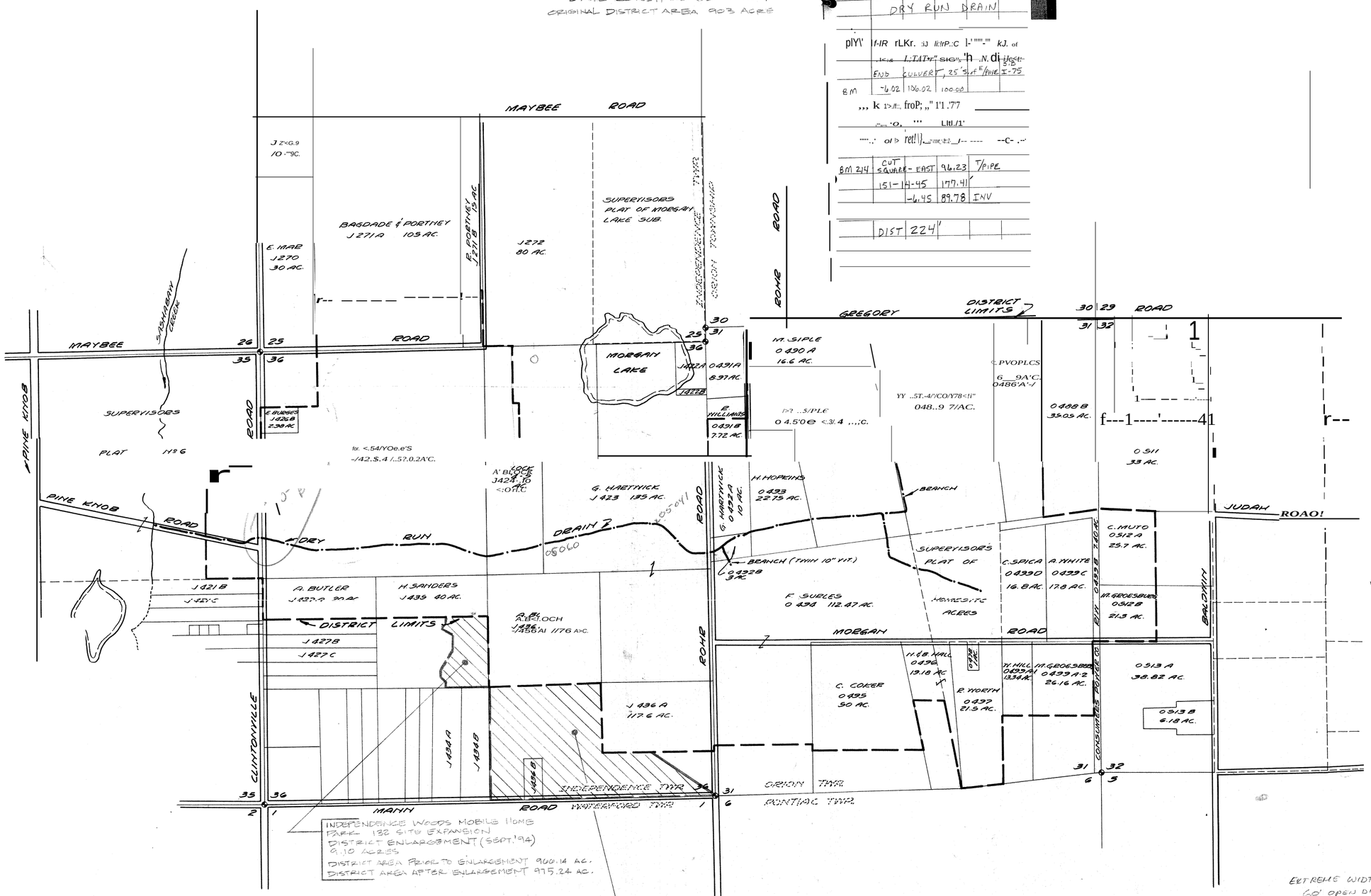
SCANNED

DATE CONSTRUCTED 1907
ORIGINAL DISTRICT AREA 903 ACRE

I-75 CULVERT
DRY RUN DRAIN

BM	END	CULVERT	25' S/of E/PIER	I-75
	-6.02	106.02	100.00	

BM 214	CUT SQUARE	EAST	96.23	T/PIPE
	151-14-45		177.41	
		-6.45	89.78	INV
	DIST	224'		



EXTREME WIDTH
60' OPEN DITCH
20' TILE

Book 14 P 150

SCANNED
JUL 12 1995

DANIEL W BARRY
DRAIN COMMISSIONER

J:"" -:-::--""-I.::OA..::K,.:.L:::A N::::D C OU:::,:N.:,:T Y M IC H IG A N--.4.:,:_ --4 .4

Designed By
Checked By
Horz. Scale 1"=600'
Vert. Scale
Field Books

DRY, RUN DRAIN

INDEPENDENCE AND ORION TOWNSHIPS

APPROVED BY
REGISTERED PROFESSIONAL ENGINEER
Date Sheet 1 of 5 Sheets

CAMP OAKLAND

p 318

158 AC.

p 321

20 AC.

p 320

40 AC.

p 323

60AC.

p 322

40 AC.

A 447

70.14AC.

A 449

42 AC.

HANDSOME

LAKE

24 25

35' 6

DRAHNER RD. 25

30

36

GJi>44f,o

'-4frc

P 456 A

15 AC.

p 442 A-I

125.35 AC.

M.C. R.R.

p 422 BI

3.65AC/

P 4 41 A

40 AC.

CAMP OAKLAND

P 457 A

80 AC.

p 456 B

65 AC·

12 79 AC.

A 454 E

15.06 AC.

A455B

5 AC.

A 454 C

33.81 AC.

A 454 J

5.IOAC

A 454F

4.80 AC.

A 454 H

4.18AC

A454 K /A454 M

9. 25 AC,

454

A 1217 AC.

BUHL

LAND CO.

A 451

40 AC.

p 441 B

40 AC.

CAMP OAKLAND

p 457

80 AC.

p 456 C

60 AC-

A 458

57.40 AC.

454 D

7.03 AC.

A 454 G

17.45AC.

A457

231 AC.

A 454 A

11 AC.

A 452

40 AC.

LAKE

P 442 A-2

125.35AC.

p 451

40 AC.

P 459 A

33 .46AC.

p 459 B

33. 20AC.

F.SG. HUGILL

p 458

40 AC.

W. a J. DENVER

p 462

80 AC.

p 463

40 AC.

A 458

57.40AC.

A 462

39.27AC.

A436 A

25.30 AC.

GRAMPIAN

HEIGHTS

P 453 A

3640AC.

P 460

13.36Ac.

p 461

40 Ac.

P 464 A 10 AC.

P 464 B-1 5 AC.

P 464 B-2 5 AC.

A461 B

A 461 C

GRAMPIAN

HEIGHTS

suB N

A459

OXFORD TOWNSHIP

P454

ASS. ROLL)

35 36

INDIAN LAKE RD.

ORION TOWNSHIP

B. HANDLMAN

0 9A

BUNNY RUN

COUNTRY CLUB

K BROWN

N 72

NOT

INCUDED

011 A

15 Ac.

0 17

410

0 18

67 AC.

LONG

LAKE

COUTRY CLUB

ANNEX

NO.I

RUN

COUNTRY

CLUB

ANNEX

NO. 5

N 73

85.66 AC.

GRAMPIAN

HEIGHTS

SUB'N

N0.2

N 69 E

608AC.

N69 A

56 AC.

LV

A. LAKE

N 69 C

AC.

MILLER RD.

ASSESSOR'S

PLAT

NO. I

COUNTRY

CLUB

BUNNY

LAKE

RUN

COUNTRY

CLUB

A. LAKE

N 74

68. 32 AC.

25 AC.

DEP'T. OF CONSERVATiON

N 79

160 AC.

0 4

35

AC.

B. R. C.C.

ANNEX N0.3

DEPT OF CONS.

N 78

34 16AC.

EAST PARK

SUB.

3 AC.

BUNNY RUN C.C.

ANNEX

0 8

20 AC.

0 202 B

912 AC.

D. ABBEY

0 198

40 AC.

0 197

77 AC.

DEP'T. OF CONS.

N 85

69. 98AC.

DEP'T OF CONS.

N 80

80 AC.

DEP'T OF CONS.

DEP'T OF CONS.

N 84

STONY CREEK RD.

214

6.70AC

0 215

12.20AC

79.50AC.

ANDERSON 8 BEKER

131. 62AC.

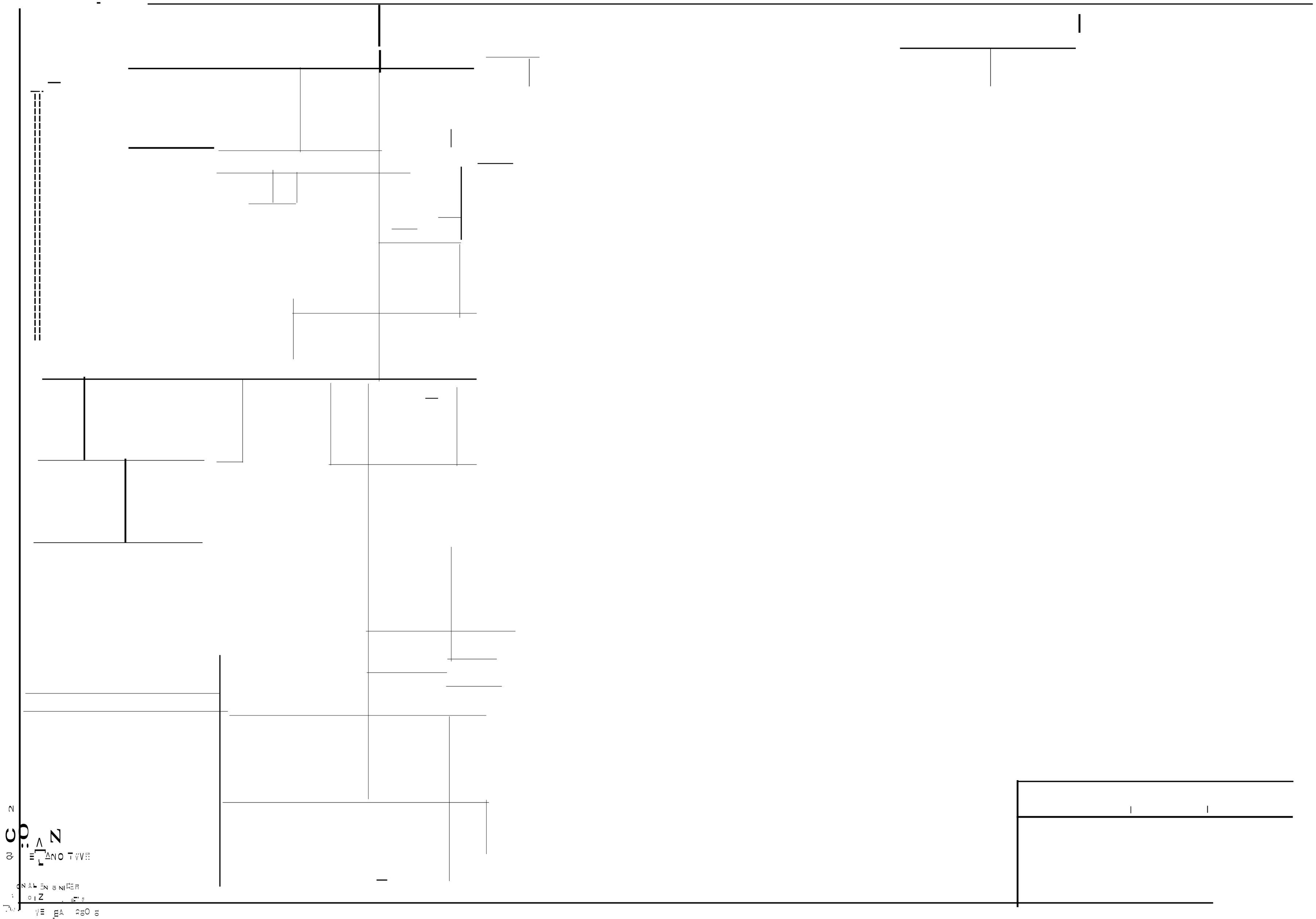
N 87

P. BEST

N 89

160 AC.

0 2 10



INDIAN LAKE RD.

RAMPIAN

A 472
40 AC.

A 471 L

A 475
160AC

A 473
20 AC.

J

A 474
20 AC.

471 H

ADDISON TOWNSHIP 32

OAKLAND TOWNSHIP 5 4

ROMEO RD.

e. DONNELL
N 62
4 4 AC.

DEP'T. OF CONS.
N 61
44 AC.

J. CHRIS TO PH E R
N 51
4 4. 63 AC.

DEPT. OF CONSERVATION
N 60
176 AC.

G. WILSON
N 50
89. 26

P'T OF CONS
N 63
44 AC.

DEP'T OF CONS.
N 64
44 AC.

A. WA!TE
N 52
44. 63AC.

A. WMTE
N 53
34 AC.

0. THOMAS

0. THOMAS
N
40AC

A. HENRY
KOTNER'S
PREDMORE
FARM

G. WILLIAMSON
N 44

DEP'T OF CONSERVATION
N 65
160 AC.

60 AC.

J. CHRISTOPHER
N55 C
60AC.

PREDMORE RD.

L. SPEZ10

GARDENS

N0.24

R. SCRIPPS
N 54
40AC.

N 68
40AC.

G. WILKINSON
N 59

80AC.

PREDMORE RD.

A J. MATHEYS

R. DREW

N 108

9 T 10

N 118 A
4AC.

DEP'T OF CONS.
N 94
40 AC.

N93A-I
21 AC.

N91A

L. SPEZI
N 90
40 AC.

N 109
19.80AC

T ULRICH
N 106

TAMARACK

N93-8
250 5AC.
AC.

N 91- B
24 AC.

40AC.

PREDMORE ACRES

J. OREW

N 110
20 AC.

GREE LAKE

HEIGHTS

40AC.

9 27

N 92

N 112

G. MORRISON
N 119

K MIDDLETON
N 101
40AC.

K.MIDDLETON
80AC.

R. SCRIPPS
80 AC.

N 105 B
153AC.

B.IOAC.

4.26AC.

N9B-91 N 100

R. SCRIPPS
NI07
40 AC.

G MORRISON

N 116
80 AC.

N 105 A
12 AC. 24.7 AC.

K. MIDDLETON
N 103
BOAC.

K. MIDDLETON
N 102
160 AC.

F. TYSON JR.
N 113
160 AC.

L. SPEZIO
N 114
80 AC.

F. SPEZIO
N 115
80 AC.

F. SPEZIO
N120
80 AC.

C. NUNN
N 121
80 AC.

N 122

8 9

STONY CREEK RD.

10 ti5---UPPER
TERMINUS

K. WOLF
N 196A
A-1
20 AC.

J. CZECHOWSKI
N 188 8
38.50AC.

W. MUIR
N 187

H.STACKHOUSE
N 186 8

C. KESTIE
N 196A-2A

BOAC.

40 AC.

F. BAKER

R.MANY

N 196 B
40AC.

N 196A-28
40AC.

40AC

RANCH
NO.Z

J.CZECHOWSKI
N 189
20AC.

A. FRANKS
N 196A-I8
34.36AC.

E.BEAROSLEY

N 190

20 AC.

LOWER
TERMINUS

N 194A-I
8 AC.

N 192
40 AC.

L. WtjiMS
N 200
32 AC.

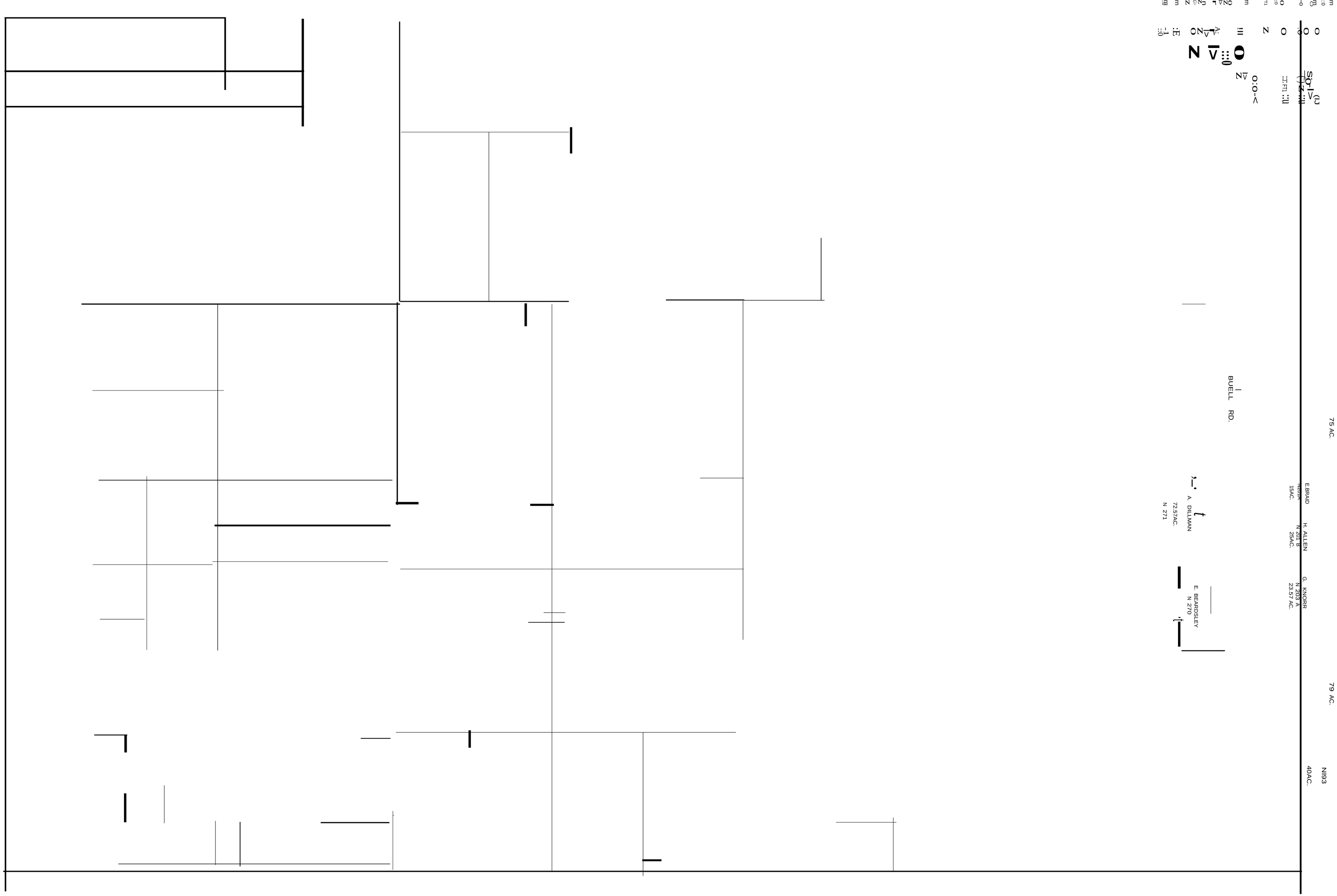
M. KNASINSK
N 202
40AC.

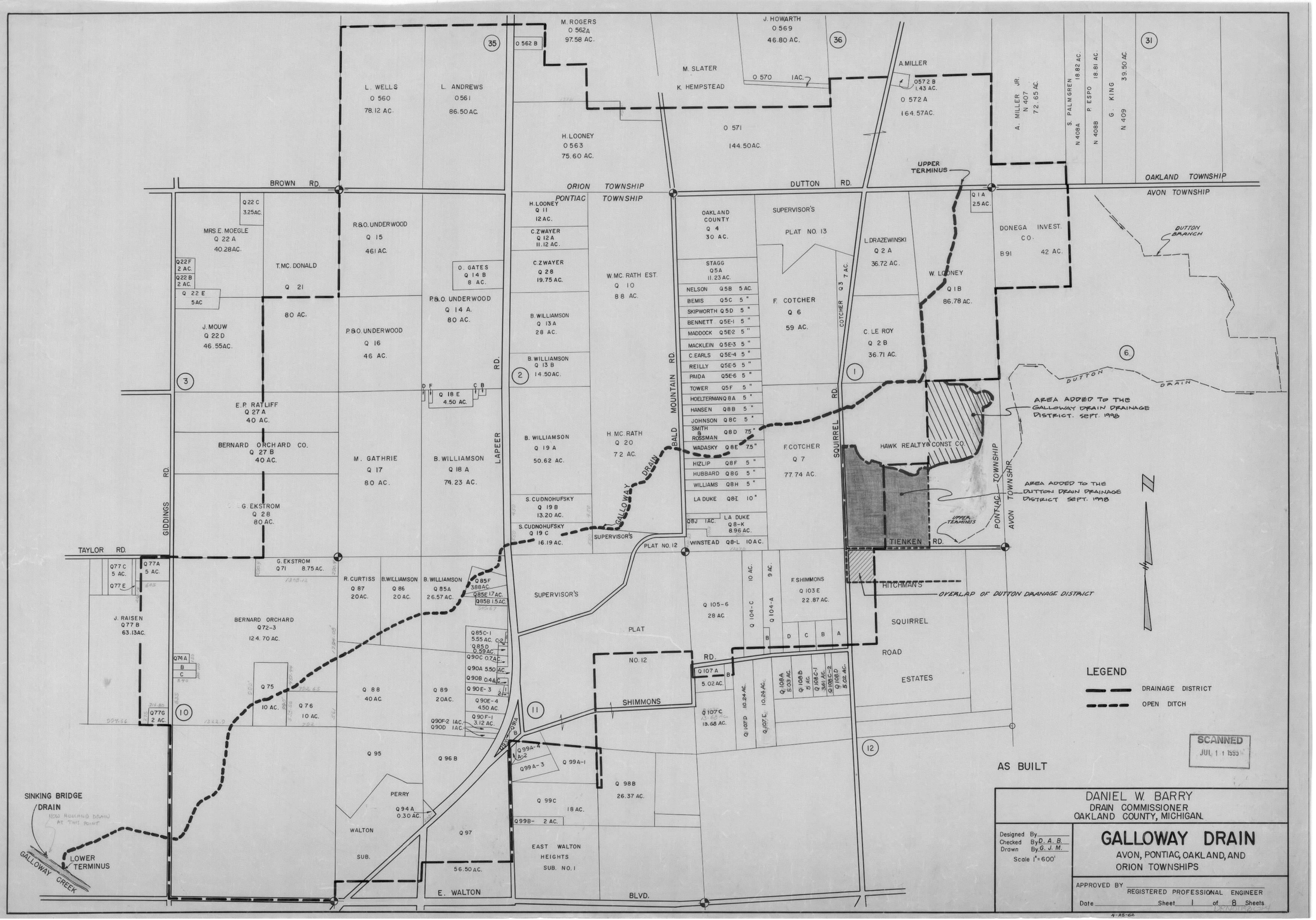
E. BEARDSLEY
N 191A

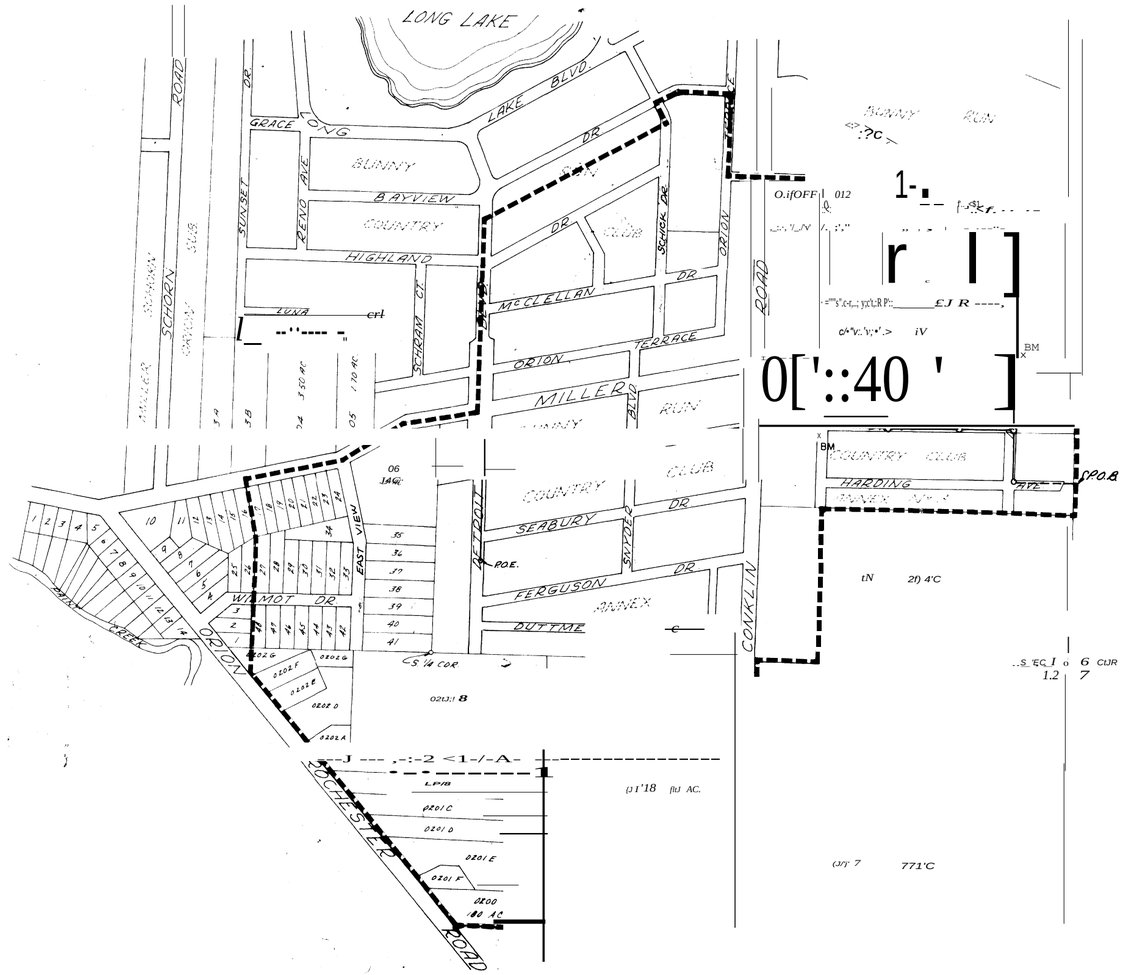
N 194A-2

3 2 AC.

N 199


BUELL RD.
A. DILLMAN
72.57AC.
N 271
E. BEARDSLEY
N 270
E.BRAID
N 202A
15AC.
H. ALLEN
N 201 B
25AC.
G. KNORR
N 203 A
23.57 AC.
75 AC.
79 AC.
N193
40AC.


BROWN RD.
DUTTON RD.
TAYLOR RD.
GIDDINGS RD.
LAPEER RD.
BALD MOUNTAIN RD.
SQUIRREL RD.
TIENKEN RD.
E. WALTON BLVD.
ORION TOWNSHIP
PONTIAC TOWNSHIP
OAKLAND TOWNSHIP
AVON TOWNSHIP
GALLOWAY DRAIN
DUTTON BRANCH
DUTTON DRAIN
SINKING BRIDGE DRAIN
GALLOWAY CREEK
LOWER TERMINUS
UPPER TERMINUS
AREA ADDED TO THE GALLOWAY DRAIN DRAINAGE DISTRICT. SEPT. 1998
AREA ADDED TO THE DUTTON DRAIN DRAINAGE DISTRICT SEPT. 1998
OVERLAP OF DUTTON DRAINAGE DISTRICT
L. WELLS 0 560 78.12 AC.
L. ANDREWS 0 561 86.50 AC.
M. ROGERS 0 562A 97.58 AC.
0 562 B
M. SLATER
K. HEMPSTEAD
J. HOWARTH 0 569 46.80 AC.
0 570 1AC.
0 571 144.50AC.
A. MILLER 0 572 B 1.43 AC.
0 572 A 164.57AC.
A. MILLER JR. N 407 72.65 AC.
S. PALMGREN N 408A 18.82 AC.
P. ESPO N 408B 18.81 AC.
G. KING N 409 39.50 AC.
H. LOONEY 0 563 75.60 AC.
MRS. E. MOEGLE Q 22 A 40.28AC.
Q 22 C 3.25AC.
Q22 F 2 AC.
Q22 B 2 AC.
Q 22 E 5AC
T. MC. DONALD Q 21 80 AC.
R.&O. UNDERWOOD Q 15 46.1 AC.
O. GATES Q 14 B 8 AC.
P.&O. UNDERWOOD Q 14 A. 80 AC.
J. MOUW Q 22 D 46.55AC.
P.&O. UNDERWOOD Q 16 46 AC.
Q 18 E 4.50 AC.
E. P. RATLIFF Q 27 A 40 AC.
BERNARD ORCHARD CO. Q 27 B 40 AC.
G. EKSTROM Q 28 80 AC.
M. GATHRIE Q 17 80 AC.
B. WILLIAMSON Q 18 A 74.23 AC.
H. LOONEY Q 11 12 AC.
C. ZWAYER Q 12 A 11.12 AC.
C. ZWAYER Q 28 19.75 AC.
B. WILLIAMSON Q 13 A 28 AC.
B. WILLIAMSON Q 13 B 14.50AC.
B. WILLIAMSON Q 19 A 50.62 AC.
S. CUDNOHUFSKY Q 19 B 13.20 AC.
S. CUDNOHUFSKY Q 19 C 16.19 AC.
W. MC. RATH EST. Q 10 88 AC.
H. MC. RATH Q 20 72 AC.
OAKLAND COUNTY Q 4 30 AC.
STAGG Q5A 11.23AC.
NELSON Q5B 5 AC.
BEMIS Q5C 5 "
SKIPWORTH Q5D 5 "
BENNETT Q5E-1 5 "
MADDOCK Q5E-2 5 "
MACKLEIN Q5E-3 5 "
C. EARLS Q5E-4 5 "
REILLY Q5E-5 5 "
PAIDA Q5E-6 5 "
TOWER Q5F 5 "
HOELTERMAN Q8A 5 "
HANSEN Q8B 5 "
JOHNSON Q8C 5 "
SMITH & ROSSMAN Q8D 7.5 "
WADASKY Q8E 7.5 "
HIZLIP Q8F 5 "
HUBBARD Q8G 5 "
WILLIAMS Q8H 5 "
LA DUKE Q8I 10 "
Q8J 1AC.
LA DUKE Q8-K 8.96 AC.
WINSTEAD Q8-L 10 AC.
SUPERVISOR'S PLAT NO. 13
SUPERVISOR'S PLAT NO. 12
F. COTCHER Q 6 59 AC.
COTCHER Q 3 7 AC.
F. COTCHER Q 7 77.74 AC.
L. DRAZEWINSKI Q 2 A 36.72 AC.
C. LE ROY Q 2 B 36.71 AC.
W. LOONEY Q 1 B 86.78 AC.
Q 1 A 2.5 AC.
DONEGA INVEST. CO. B 91 42 AC.
HAWK REALTY & CONST. CO.
HITCHMAN'S SQUIRREL ROAD ESTATES
F. SHIMMONS Q 103 E 22.87 AC.
Q 105-6 28 AC.
Q 104-C 10 AC.
Q 104-A 9 AC.
Q 107 A 5.02 AC.
Q 107 C 13.68 AC.
Q 107 D 10.24 AC.
Q 107 E 10.24 AC.
Q 108 A 5.03 AC.
Q 108 B 5 AC.
Q 108 C-1 3.41 AC.
Q 108 C-2
Q 108 D 5.02 AC.
Q 75 10 AC.
Q 76 10 AC.
Q 77 C 5 AC.
Q 77 E
Q 77 A 5 AC.
Q 77 G 2 AC.
J. RAISEN Q 77 B 63.13AC.
G. EKSTROM Q 71 8.75 AC.
BERNARD ORCHARD Q 72-3 124.70 AC.
R. CURTISS Q 87 20 AC.
B. WILLIAMSON Q 86 20 AC.
B. WILLIAMSON Q 85 A 26.57 AC.
Q 85 F 3.88 AC.
Q 85 E 1.7 AC.
Q 85 B 1.5 AC.
Q 85 C-1 5.55 AC.
Q 85 D 0.59 AC.
Q 90 C 0.7 AC.
Q 90 A 5.50 AC.
Q 90 B 0.4 AC.
Q 90 E-3
Q 90 E-4 4.50 AC.
Q 90 F-1 3.12 AC.
Q 90 F-2 1 AC.
Q 90 D 1 AC.
Q 74 A
Q 95
Q 96 B
Q 97
Q 88 40 AC.
Q 89 20 AC.
Q 99 A-4
Q 99 A-3
Q 99 A-1
Q 99 C 18 AC.
Q 99 B- 2 AC.
Q 98 B 26.37 AC.
PERRY Q 94 A 0.30 AC.
WALTON SUB.
EAST WALTON HEIGHTS SUB. NO. 1
56.50 AC.
LEGEND
DRAINAGE DISTRICT
OPEN DITCH
SCANNED JUL 1 1 1999
AS BUILT
DANIEL W. BARRY
DRAIN COMMISSIONER
OAKLAND COUNTY, MICHIGAN
Designed By
Checked By D. A. B.
Drawn By G. J. M.
Scale 1"=600'
GALLOWAY DRAIN
AVON, PONTIAC, OAKLAND, AND ORION TOWNSHIPS
APPROVED BY
REGISTERED PROFESSIONAL ENGINEER
Date
Sheet 1 of 8 Sheets
4-25-62



1-

r l]

0[':40 ']

LEGEND

DRAINAGE DISTRICT LIMIT

ENCLOSED. SEWER

OPEN DITCH

BENCH MARK BM X

MARK	BULLETIN	DATE	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE
	Per Oakland Co. Drain Comm.							

DA IEL. W\ BARRY ,:
DRAIN VA.etMI SSIONER
OA-KL MI HIGAN

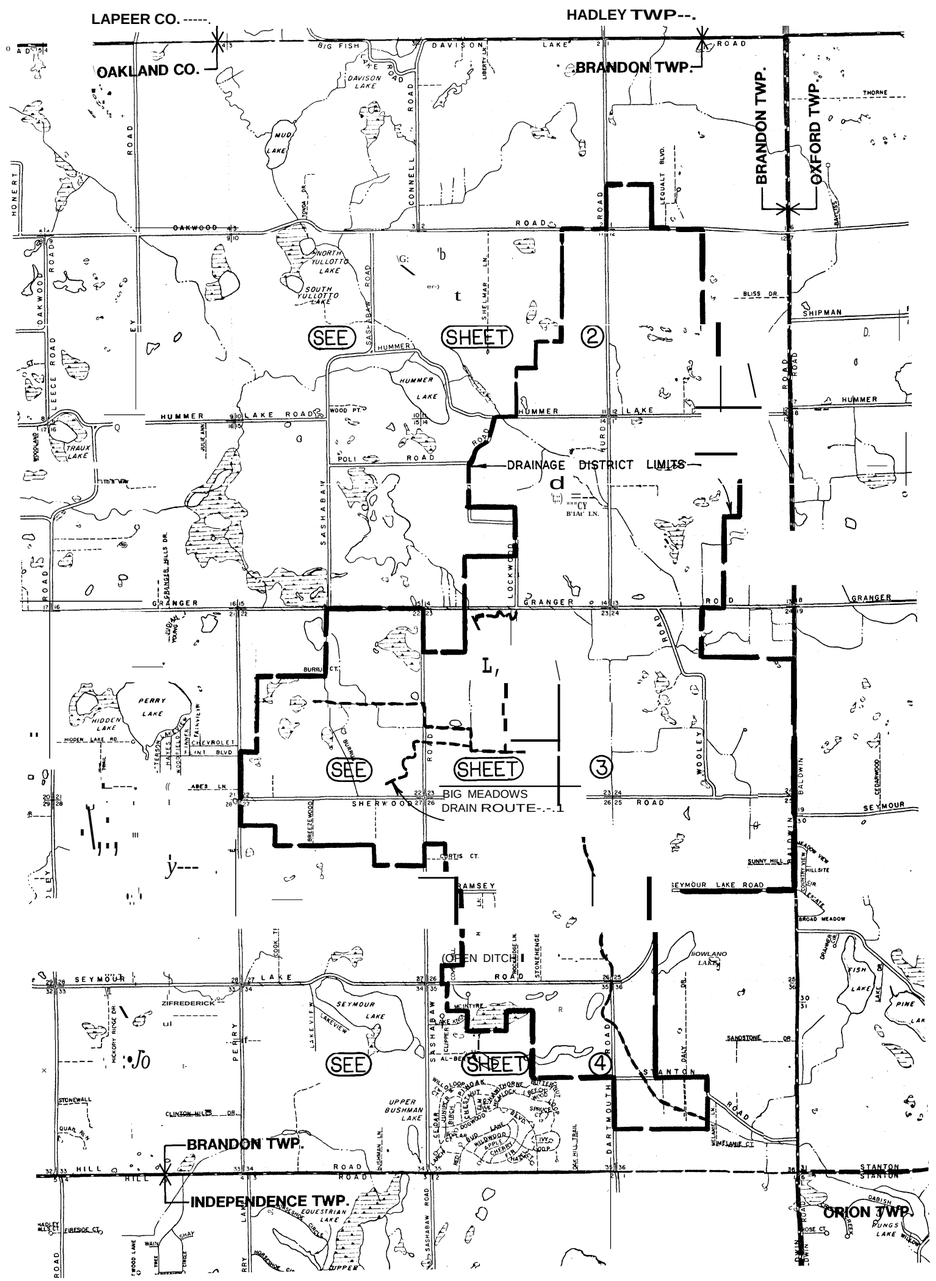
.JOHN-SON 8c ANDERSON, INC.
'(IONIIH,TIN!f J:.NGIN,EERS
'ONJiiA J:IIICHI AN

AS-BUIL -- PL;ANS.

3-13-70 J.R.C.

OSGOOD DRAIN
SECTION I OF ORION TOWNSHIP
OAKLAND COUNTY MICHIGAN

SCANNED JUL 2 8 1995



NOTE:
THE DRAIN DISTRICT, ROUTE AND OTHER INFORMATION ON THIS MAP HAS BEEN PLOTTED BY VISUAL AND SCALING METHODS

PRIVATE MAPS OR M:RIAL PHOTOS AS LISH:II.
THE RELATIONSHIP OF THE DRAIN ROUTE AND BOUNDARY TO TiIE

TIONAL PURPOSES ONLY. TiIE EXACT DIMENSIONS OF THE DRAIN ROUTE AND BOUNDARY MAY BE fOUND IN TiIE LEGAL

NOTE:
THE BIG MEADOWS DRAIN ; THE COWDEN DRAIN AND THE PAINT CREEK DRAIN ARE ALL OVERLAPPING. SEE INDIVIDUAL COVER SHEETS TO SEE THE LOCATION OF EACH DRAIN.

GEORGE W. KUHN
OAKLAND COUNTY DRAIN COMMISSIONER
ONE PUBLIC WORKS DRIVE, WATERFORD, MICHIGAN 413328-1907

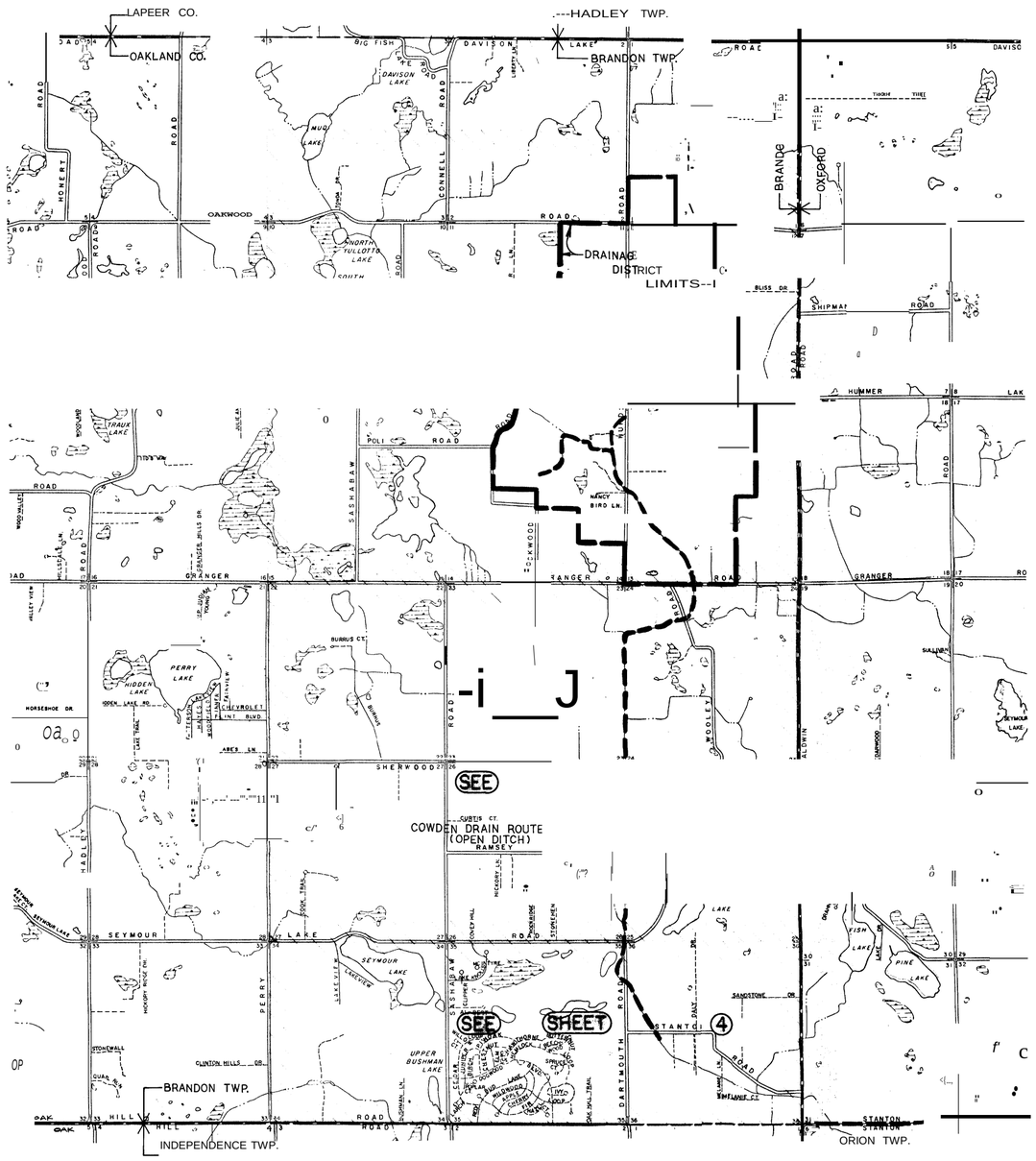
BIG MEADOWS DRAIN UPDATE

BRANDON TOWNSHIP

COVER SHEET

DESIGNED BY: REV.
DRAWN BY: K.W. REV.
DATE: 2-25-91 REV.

SHEET NO.
OF 4



SCALE: 1": 200o':!:

IIQ!!.:

THE DRAIN DISTRICT, ROUTE AND OTHER INFORMATION ON THIS MAP • HAS BEEN PLOTTED BY VISUAL AND SCALING METHODS " FROM EX I STING DRAIN HAPS, OTIJr:R GOVEHNMENTAL MAPS, PRIVATE MAPS OR AERIAL I!IOTOS AS LISTED.

THE RELATIONSHIP OF THE DRAIN ROUTE AND BOUNDARY TO THE PROPERTIES SHOWN ON THIS MAP ARE FOR GENERAL INFORMATIONAL PURPOSES ONLY. THE EXACT DIMENSIONS OF THE **DRAIN ROUTE AND BOUNDAKY MAY BE FOUND IN THE LEGAL** DRAIN RECORDS.

NOTE:
THE COWDEN DRAIN, THE BIG MEADOWS DRAIN AND THE PAINT CREEK DRAIN ARE ALL OVERLAPPING. SEE INDIVIDUAL COVER SHEETS TO SEE THE LOCATION OF EACH DRAIN.

SCANNED
JUlt

GEORGE W. KUHN
OAKLAND COUNTY DRAIN COMMISSIONER
ONE PUBLIC WORKS DRIVE. WATERFORD. MICHIGAN 48328-1907

COWDEN DRAIN UPDATE
BRANDON TOWNSHIP

COVER SHEET

DESIGNED BY:	REV.	SHEET NO.
DRAWN BY: K.W.	REV.	
DATE: 2-25-91	REV.	OF 4

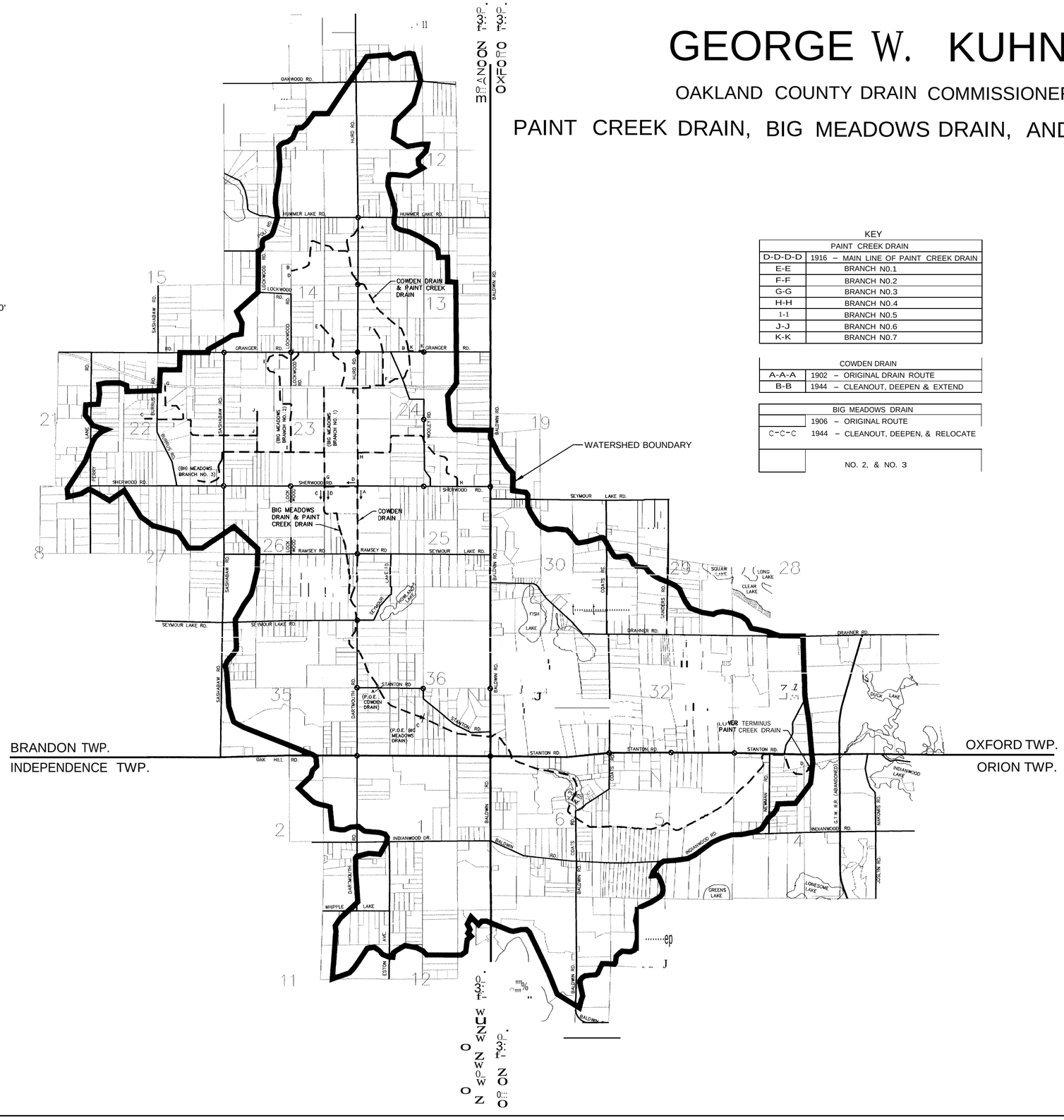
GEORGE W. KUHN

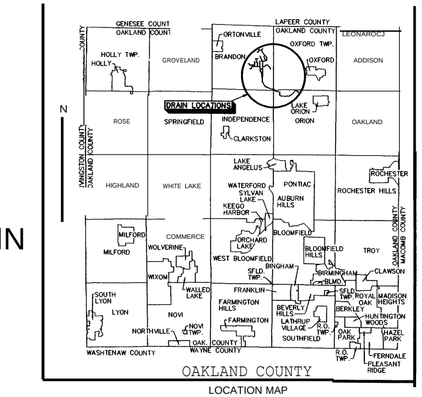
OAKLAND COUNTY DRAIN COMMISSIONER

PAINT CREEK DRAIN, BIG MEADOWS DRAIN, AND COWDEN DRAIN

N

SCALE: 1" – 2000'





LOCATION MAP
NO SCALE

KEY

PAINT CREEK DRAIN	
D-D-D-D	1916 – MAIN LINE OF PAINT CREEK DRAIN
E-E	BRANCH N0.1
F-F	BRANCH N0.2
G-G	BRANCH N0.3
H-H	BRANCH N0.4
1-1	BRANCH N0.5
J-J	BRANCH N0.6
K-K	BRANCH N0.7

COWDEN DRAIN	
A-A-A	1902 – ORIGINAL DRAIN ROUTE
B-B	1944 – CLEANOUT, DEEPEN & EXTEND

BIG MEADOWS DRAIN	
	1906 – ORIGINAL ROUTE
C-C-C	1944 – CLEANOUT, DEEPEN, & RELOCATE
	NO. 2, & NO. 3

LEGEND

X 1037.6	EXISTING SPOT ELEVATION
. 1040 ...	EXISTING CONTOUR
-·1·-·-1-	EDGE OF DRAIN CENTERLINE OF DRAIN EDGE OF DRAIN
I>	EXISTING END SECTION
-O-	UTILITY POLE
O	SECTION CORNER
	EXISTING BUILDING
O	TREE
*	PINE TREE
	TREE LINE or BRUSH
|||||	MARSH
–x–x–	FENCE

NOTE:
THIS MAP IS A COMPOSITE OF SEVERAL "SIDWELL" PROPERTY DESCRIPTION MAPS ISSUED IN THE YEAR OF 1989, COPYRIGHT BY LAND DATA, INC. THE WATERSHED BOUNDARY, ROUTES, AND OTHER INFORMATION ON THIS MAP HAVE BEEN PLOTTED BY VISUAL AND SCALING METHODS FROt EXISTING O.C.D.C DRAIN MAPS, OTHER GOVERNMENTAL MAPS, PRIVATE MAPS, OR AERIAL PHOTOGRAPHS. IHE RELATIONSHIP OF THE DRAIN ROUTE AND BOUNDARY TO THE PROPERTIES SHOWN ON THIS MAP ARE FOR GENERAL INFORMATION PURPOSES ONLY. IHE EXACT DIMENSIONS OF THE DRAIN ROUTIE AND BOUNDARY MAY BE FOUND IN THE O.C.D.C. LEGAL DRAIN RECORDS.

AERIAL TOPOGRAPHIC INFORMATION PROVIDED BY:
ABRAMS AERIAL SURVEY CORPORATION
DATIE FLOWN: APRIL 7, 1993 .
A.A.S.C. JOB NO. 24918

SCANNED
2 4 1996

No.	By	Ck.	Description	Date
2	BJS	DAP	PER COUNTY REVIEW	1-96
1	BJS	DAP	FINAL SUBMISSION	6-96

GEORGE W. KUHN
OAKLAND COUNTY DRAIN COMMISSIONER
ONE PUBLIC WORKS I MI 48328-1907

PAINT CREEK DRAIN, BIG MEADOWS DRAIN, AND COWDEN DRAIN

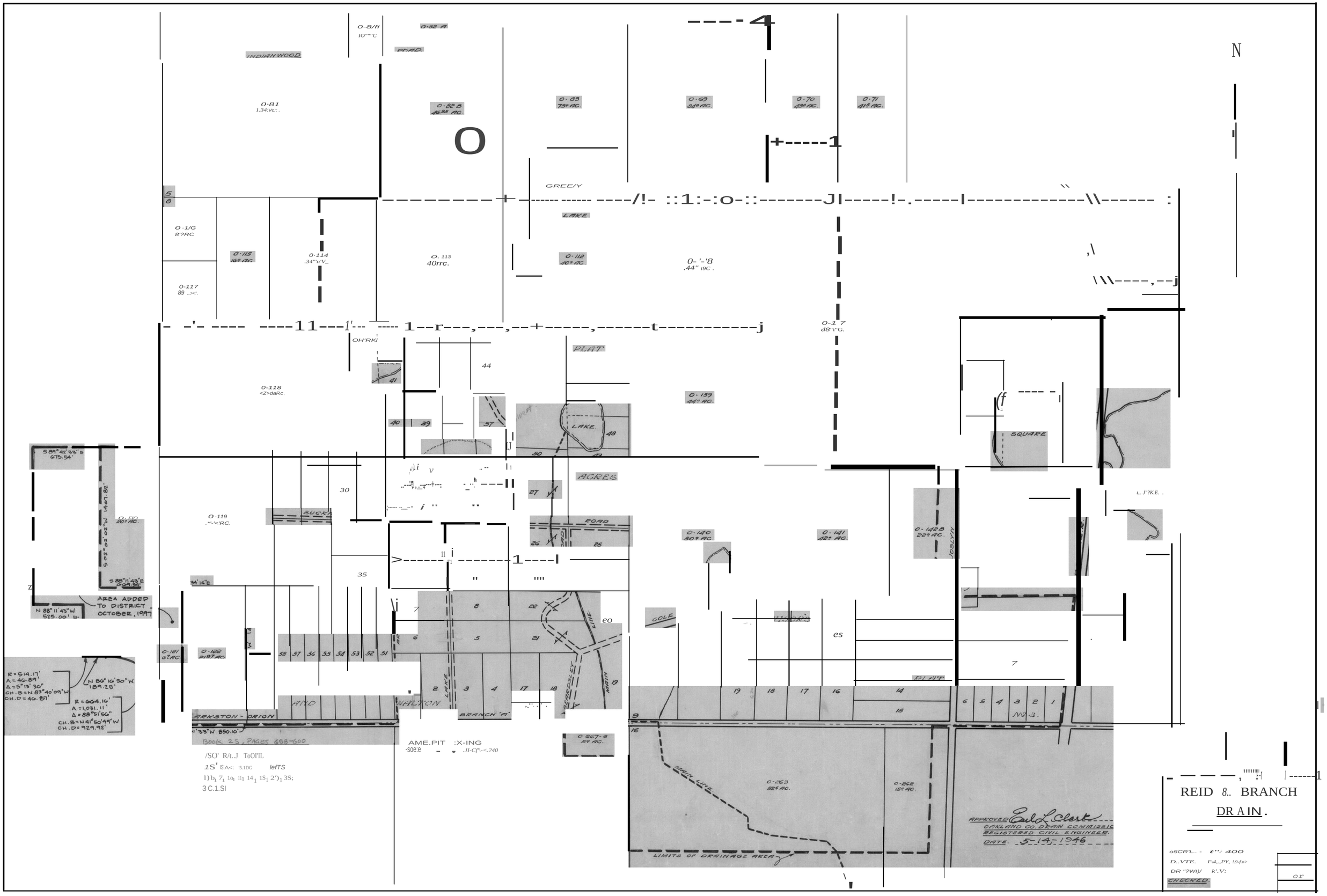
OVERALL DRAINAGE MAP

BRANDON, OXFORD, INDEPENDENCE, AND ORION TOWNSHIPS

DES. PC. SCALE 1"=2000' JOB NO. 93039
DN. BJS CK. DAP DATE 12-01-95 DWG. NO. 1

PROFESSIONAL ENGINEERING ASSOCIATES
2430 Rochester Ct. Sle 100
Troy, MI 48083-1872
(810) 689-9090

DRN05343.GP4


N
INDIAN WOOD
ROAD
GREEN LAKE
PLAT
SQUARE
BUCKS ROAD
ARKSTON - ORION ROAD
WALTON LAKE
BRANCH "A"
MAIN LINE
LIMITS OF DRAINAGE AREA
AREA ADDED TO DISTRICT OCTOBER, 1997
BOOK 25, PAGES 598-600
APPROVED Earl L. Clark
OAKLAND CO. DRAIN COMMISSIONER
REGISTERED CIVIL ENGINEER.
DATE. 5-14-1946
REID & BRANCH
DRAIN.
CHECKED

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2S:5.9 AC.

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067/ 9'3Ac.

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f¥/.31'9
2d #„

t;I-'C
6-9&Nc.

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G /0 B
20 Ac.

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f?/9 /?-1
36.5fil Ac..

Q/81'1

7 .23A.::.

fP/7 80/lc.

Q2.88

4' 28 A

t;'20C

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!i./2 Ac, B.oAc .

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GS4-2 SAc.
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SAc..

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S/k .
SRc-
SI9c.

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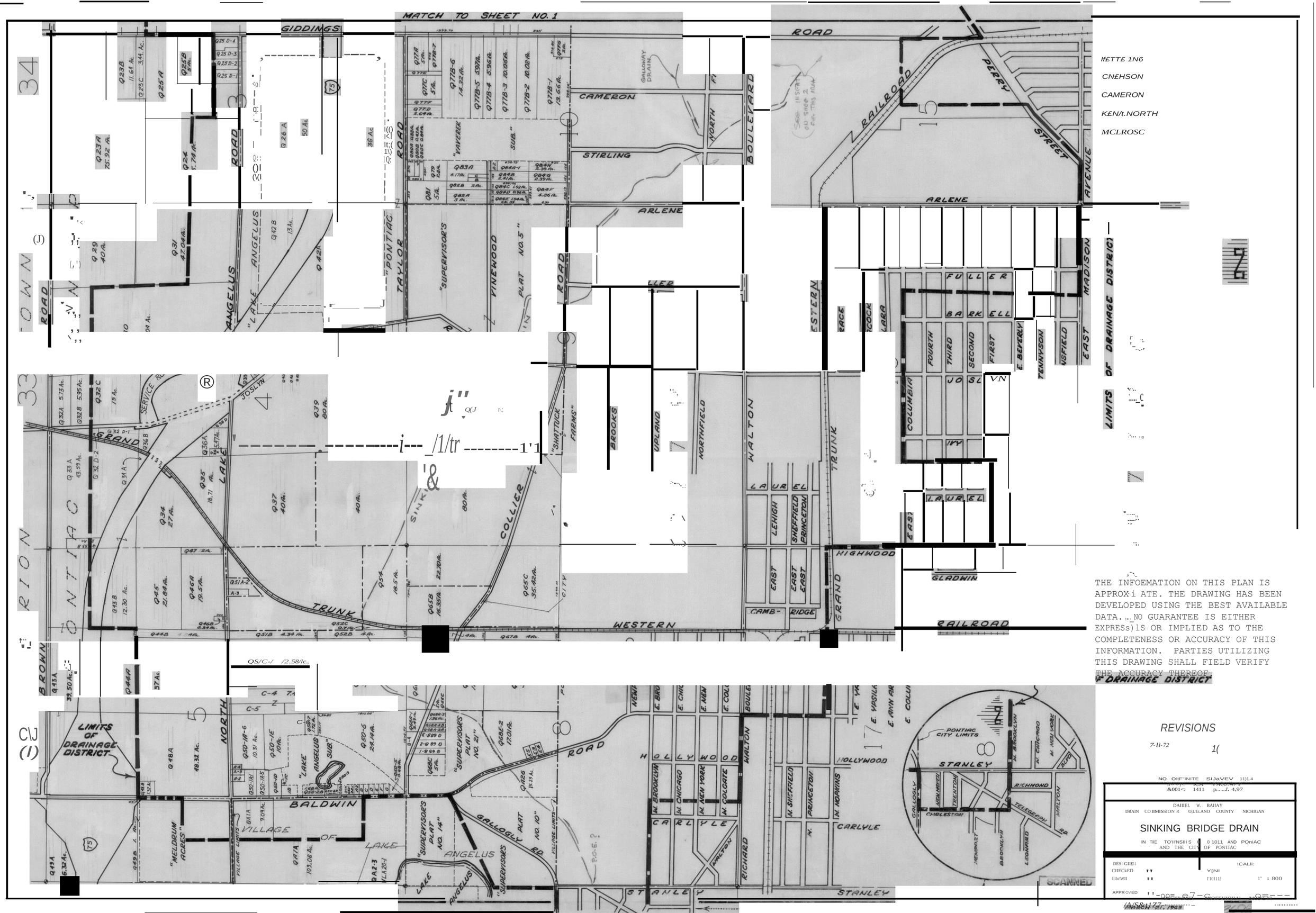
MATCH TO SHEET NO. 1
GIDDINGS
ROAD
CAMERON
STIRLING
NORTH
BOULEVARD
ARLENE
RAILROAD
PERRY
STREET
AVENUE
MADISON
EAST
FULLER
BARKELL
FIRST
SECOND
THIRD
FOURTH
COLUMBIA
JOSLYN
LAUREL
GLADWIN
HIGHWOOD
GRAND
TRUNK
WESTERN
RAILROAD
COLLIER
SINKING
LAKE
ANGELUS
"LAKE ANGELUS SUB."
"PONTIAC TAYLOR ROAD"
"SUPERVISOR'S PLAT NO. 5"
VINEWOOD
"SUPERVISOR'S PLAT NO. 21"
"SUPERVISOR'S PLAT NO. 14"
GALLOGLY PLAT NO. 10"
GALLOGLY RD.
BALDWIN
VILLAGE OF LAKE ANGELUS
"MELDRUM ACRES"
NORTHFIELD
WALTON
BROOKS
UPLAND
"SHATTUCK FARMS"
HOLLYWOOD
CARLYLE
STANLEY
RICHARD
PONTIAC CITY LIMITS
RICHMOND
TELEGRAPH
LIMITS OF DRAINAGE DISTRICT
LIMITS OF DRAINAGE DISTRICT
QS/C-/ /2.58/lc..
THE INFOEMATION ON THIS PLAN IS APPROX·i ATE. THE DRAWING HAS BEEN DEVELOPED USING THE BEST AVAILABLE DATA. NO GUARANTEE IS EITHER EXPRESs)1S OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY OF THIS INFORMATION. PARTIES UTILIZING THIS DRAWING SHALL FIELD VERIFY THE ACCURACY THEREOF.
DRAINAGE DISTRICT
REVISIONS
7-Ii-72
NO OIIF"INITE SIJaVEV 11)1.4
&001<: 1411 p.....f. 4,97
DAIIIEL W. BAIIAY
DRAIN CO HMISSION R O,UEL:ANO COUNTY NICHIGAN
SINKING BRIDGE DRAIN
IN TIE TO'IfNSIII S 0 1011 AND POniAC AND THE CITY OF PONTIAC
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CHECKED
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APPROVED
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Y[NI
1'1011!!
1" : 800
SCANNED

VOLUME & ORIFICE CALCULATIONS

DEFINITIONS

Q_a	Allowable outflow, cfs
R	Allowable runoff rate, cfs/acre
A	Area of imperviousness, acres
C	Weighted runoff coefficent
Q_o	Maximum outflow, cfs/acre
T	Storage time, minutes
V_s	Maximum volume of storage per acre of imperviousness, cf
V_t	Total volume of storage required, cf
V_r	Volume of storage required, cft
A_m	Median Surface Area, sft
h_1 & h_{100}	Total head on orifice measured from the design water level, ft
A_{o1} & A_{o100}	Orifice Area, sqin
c	Orifice Coefficent (typically 0.62)
g	Gravitational Constant, 32.2 ft/s^2
D	Diameter, in
A	Area of Orifice at the bottom of the basin, sft

Required Detention Volume Calculations

Q_a= R*A (typical calculation for sites governed by runoff rate)

Q_o = Q_a / (A * C)

T = -25 + (10312.5 / Q_o) ^ (0.5)

V_s = [(16500 * T) / (T +25)] - 40 * Qo * T

V_t = V_s * A * C

Required Forebay Volume & Outlet Size Calculations

V_r = 4320 * C * A

A_m = V_r / h_1

A_{o1} = [0.3988 * A_m * (h_1) ^ (0.5)] / 172800 * 144

100-Year Outlet Size Calculations

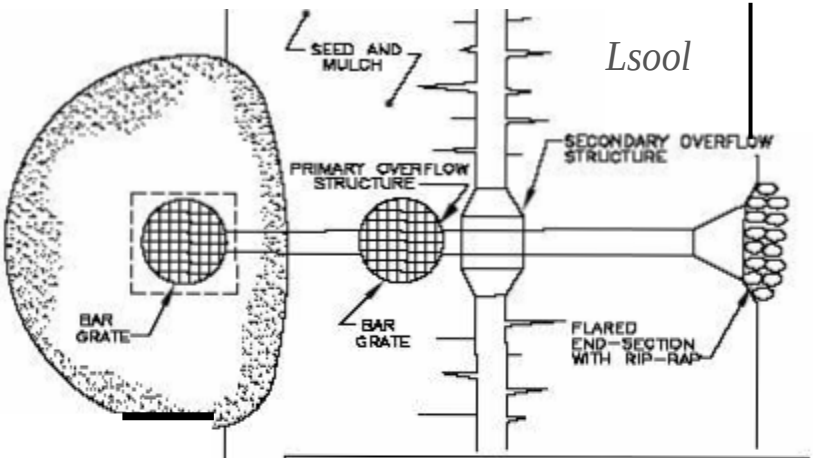
A_{o100} = Q_a / [c * (2 * g * h_{100}) ^ (0.5)] * 144

D = 2 * (A / Pi) ^ (0.5)

Required Retention Volume Calculations

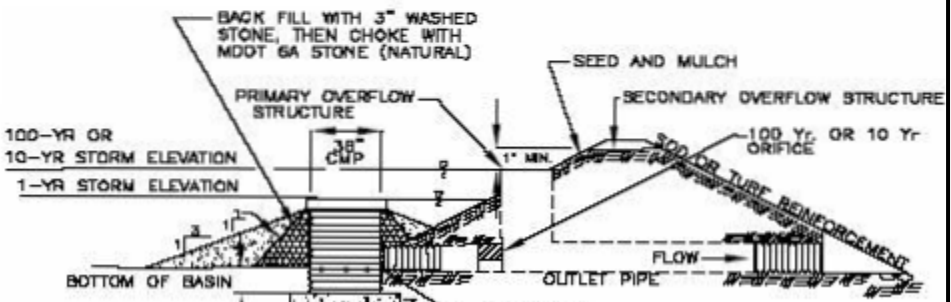
V_t = 2 * 16,500 * A * C

TEMPORARY DETENTION BASIN OUTLET FILTER(CMP) OS-2



PLAN VIEW

NOTE: EXTREME CARE MUST BE EXERCISED TO INSURE THAT THE OUTLET HOLES IN THE STANDPIPE, DO NOT BECOME CLOGGED WITH SEDIMENT.



THE OUTLET HOLES MUST I!: PLACto AT THE BOTTOM OF 1HE ''' SIN AND 1\ollii;IA CAPACITY MUST SE SUCH THAT A ..eRI00 OF AT LEAST 48 HOURS WILL 8E REQUIR!!:D TO OUTtET' A 1-'I'EAR STORM VDWUE. SEC OAICLANQ COUNTY DRAIN CON.ISSIONERS SEDI"\W " & R,§SGN CB1JIBIA FOR NUUBIR O I' CtiS AE:QUIIt£D.

PROFILE VIEW

APPENDIX E

RETAINING WALL CERTIFICATION FORM

Date: _____

Randy McClure, Building Official
CHARTER TOWNSHIP OF ORION
2525 Joslyn Road
Lake Orion, Michigan 48360

Regarding:
Retaining Wall Review for:
P.C. #:
Sidwell #: _____

Design Engineer and Firm Name:
Address:_____
Phone:_____Fax:_____

Owner:_____
Address:_____
Phone:_____Fax:_____

A retaining wall(s) is proposed for the above referenced site. The wall(s) was designed to all applicable structural design codes, more specifically known as _____, and all necessary loads (including vehicular surcharge) have been incorporated into the design. In addition, the wall meets or exceeds minimum factors of safety against both overturning and sliding, where the safety factors are as follows _____.

A retaining wall detail has been incorporated into the drawings and has been submitted for review.

Seal

Sincerely,

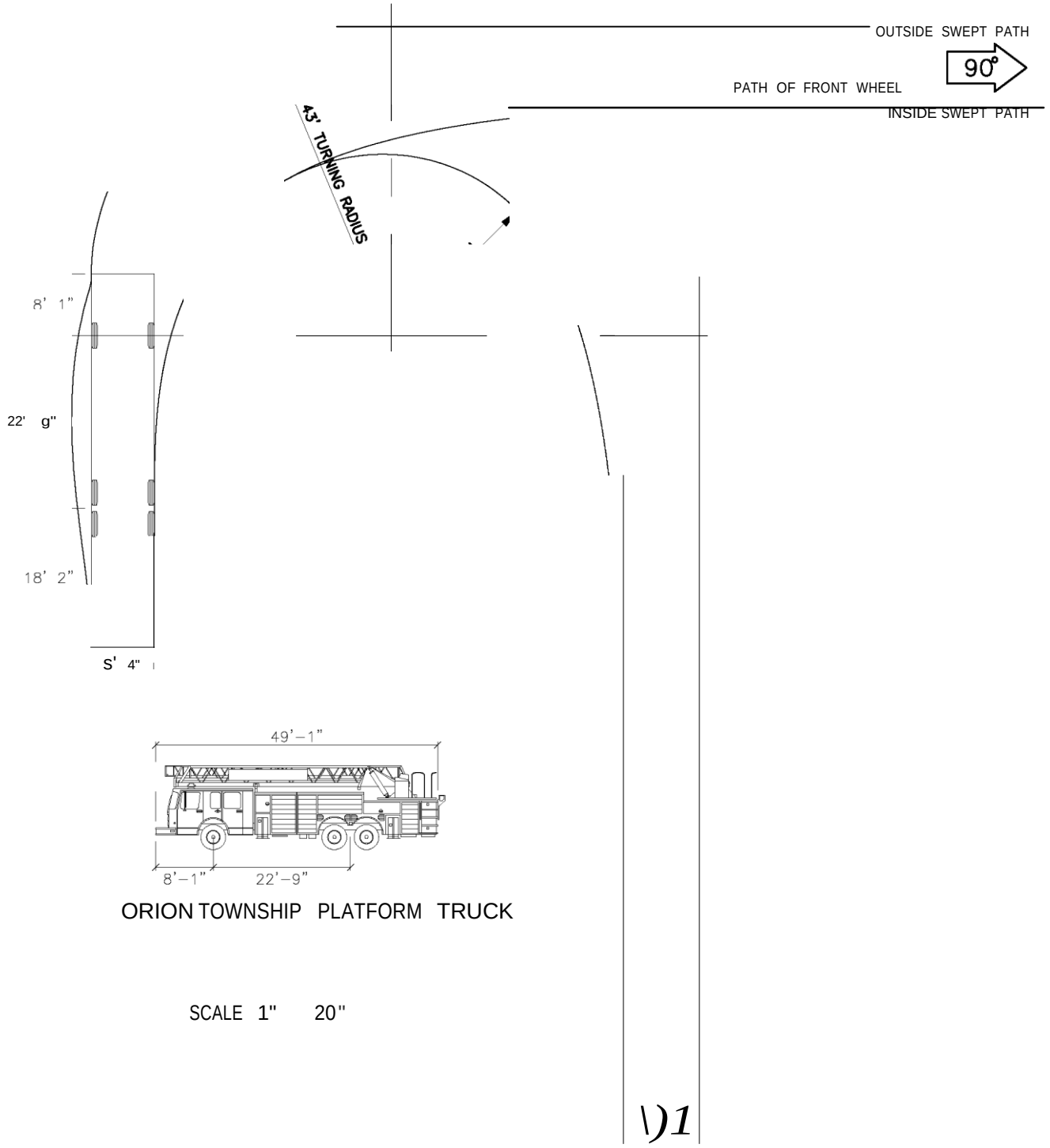
_____
Printed Name of Professional Engineer

_____
Signature

cc: James C. Stevens, P.E., OHM. Advisors, 34000 Plymouth Road, Livonia, MI 48150

APPENDIX F

ORION TOWNSHIP FIRE DEPARTMENT
LADDER TRUCK TURNING TEMPLATE



ORION TOWNSHIP PLATFORM TRUCK

SCALE 1" 20"

\)1

ORION TOWNSHIP

OHM
Advancinq Communities

INFORMATION CONTAINED HEREIN WAS PROVIDED BY THE CHARTER TOWNSHIP OF ORION FIRE DEPARTMENT

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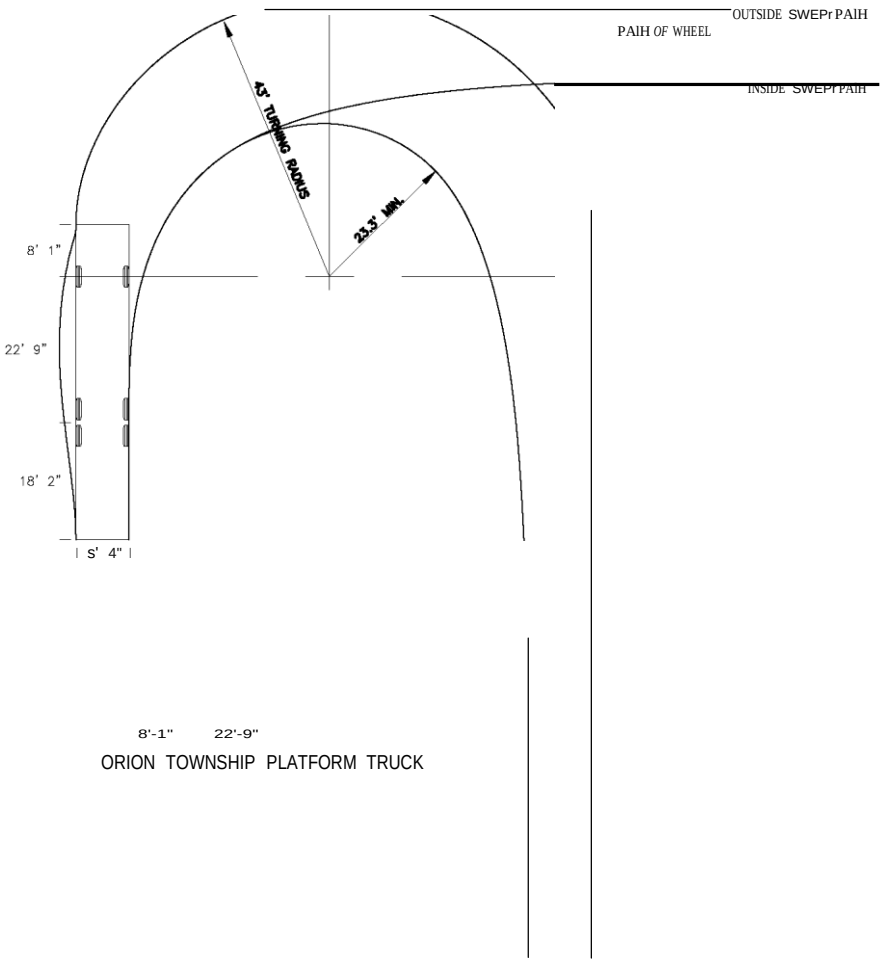

ORION TOWNSHIP PLATFORM TRUCK

SCALE 1))

OHM
Advancin.Q Communities

INFORMATION CONTAINED HEREIN WAS PROVIDED BY THE CHARTER TOWNSHIP OF ORION FIRE DEPARTMENT

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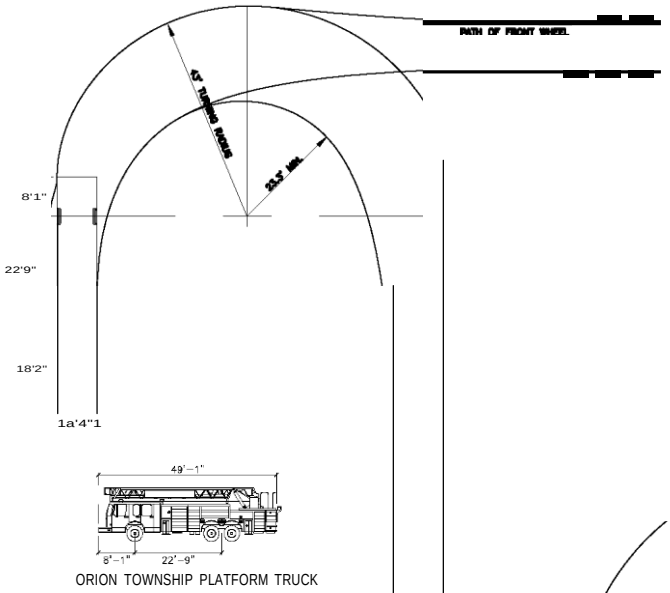
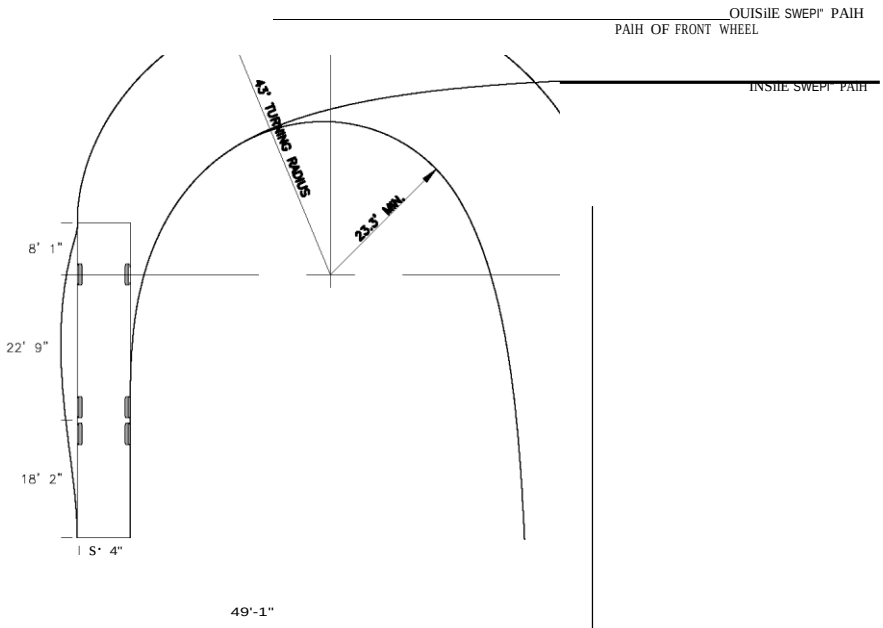


ORION TOWNSHIP PLATFORM TRUCK

SCALE 1" = 40"

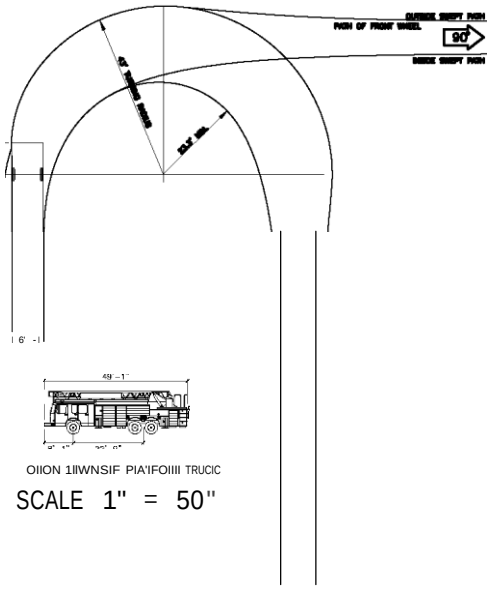


O O

s'-1" 22'-9"

ORION TOWNSHIP PLATFORM TRUCK

SCALE 1" 30"



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SCALE 1" = 50"

OHM

Advancin.Q Communities

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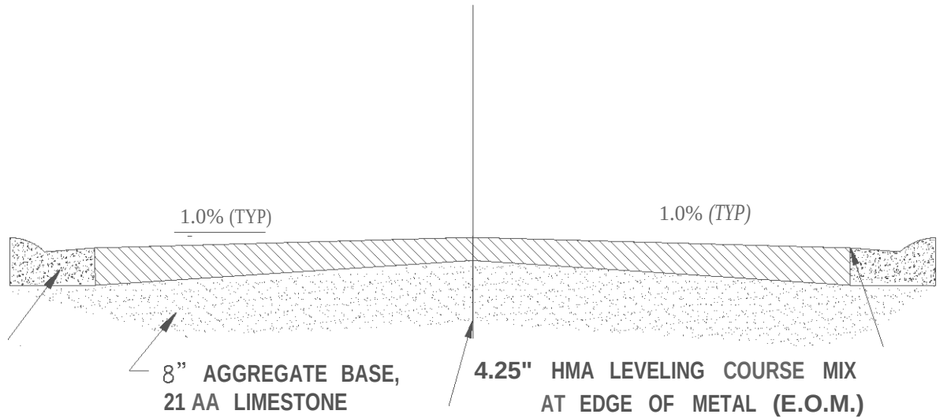
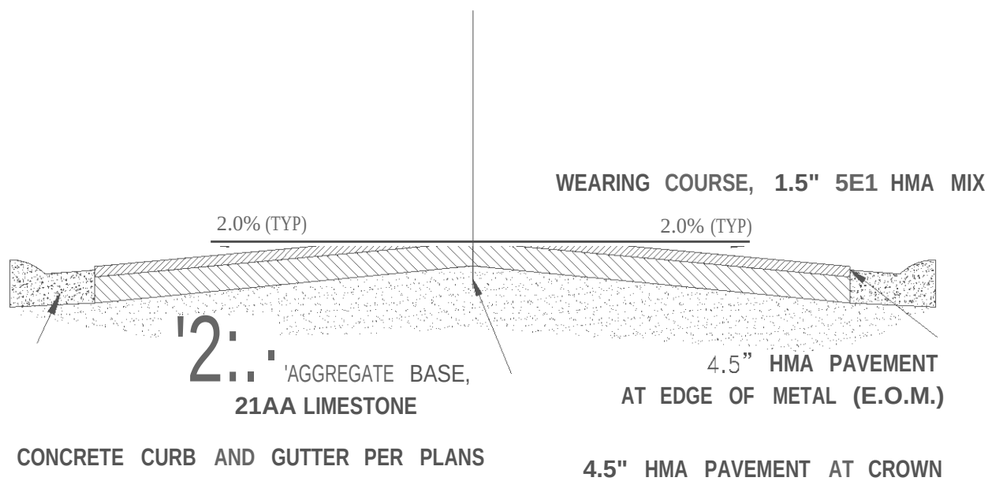
APPENDIX G

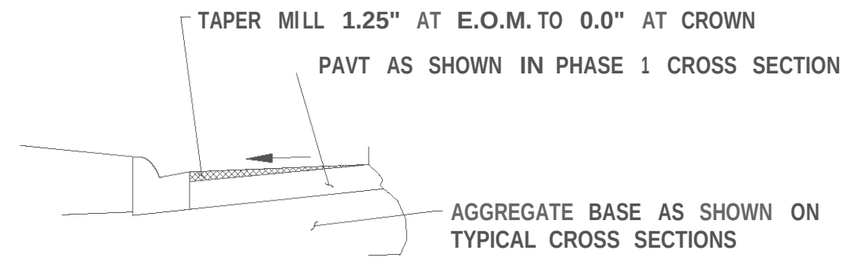
SUBDIVISION ASPHALT PAVING DETAIL



PHASE 1 CROSS SECTION FOR CONSTRUCTION



PHASE 2 CROSS SECTION FOR FINAL PAVING OF ROADWAY



MILLING DETAIL

PHASE 1 CROSS SECTION NOTES:

o. In all cases, after the initial rough grading, the subgrode shall be inspected by the Developer's hired testing company. Corrective measures may be required for the subgrade, including but not limited to: subgrode undercutting, backfill with suitable material, or geotextile stabilization.

b. Asphalt for Phose 1 shall be placed in o single lift and HMA grade shall be even with the gutter grade to provide on avenue for stormwater runoff to reach storm structures during building construction.

MILLING PHASE NOTES:

c. Base repairs must be completed for any compromised pavement before the wearing course is placed. If bose repairs ore appropriate to occur before the milling process then they should be completed at that time.

d. Milling of HMA Bose shall be performed upon the completion of building construction activity within the site.

PHASE 2 CROSS SECTION NOTES:

e. Asphalt shall be topped with 5E1 Mix at 1.5" in thickness.

f. Between the milled surface and the wearing course place SS-1 h at o rote of 0.05 Goi/Syd.

g. The HMA should be *t* to *t* above the concrete gutter at the edge of pavement at completion of wearing course placement.

OHM

CITY/VILLAGE/TOWNSHIP: TOWNSHIP OF ORION
JOB #
OT-PAVEMENT DET SUBDIVISION
SCALE H: N.T.S V: N.T.S
HORIZ DATUM VERT DATUM
REVISIONS:
DATE:

COUNTY: OAKLAND COUNTY
DATE:

BID DATE | CADD KVK | ENGINEER JCS | PROJ MGR JCS | SECTION | TOWN 4N | RANGE 10E
CLIENT: TOWNSHIP OF ORION
DATE:
REVISIONS:

34000 Plymouth Road | Livonia, MI 48150 | P (734) 522-6711 | F (734) 522-6427 | WWW.OHM-ADVISORS.COM

SIEET 1 OF1

DRAWING PATH: P:\0101_0125\0121150031_Engineering Standards\Orion Appendices\Appendix G\Subdivision Paving Detail.dwg Mar 03, 2018 - 1:10pm