CITY OF SIDNEY
DESIGN CRITERIA

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800.00 Water Distribution

900.00 Sanitary Sewers

CITY OF SIDNEY
DESIGN CRITERIA REGISTRATION

Name: _____

Title: _____

Firm/Organization: _____

Address: _____

Telephone: _____

CHANGE OF ADDRESS CARD for receiving updates of the City of Sidney Design Criteria.

(OLD INFORMATION)

Name: _____

Title: _____

Firm/Organization: _____

_____

Telephone: _____

(NEW INFORMATION)

Name: _____

Title: _____

Firm/Organization: _____

_____

Telephone: _____

FOREWORD

This manual has been prepared to aid engineers and Developers in the preparation of development plans and engineering design and to inform interested persons of the procedures and standards for the City of Sidney, Ohio. It is also intended to be used during reconstruction or replacement of existing facilities or utility construction within the City right-of-way. The rules, standards, specifications, criteria, etc. are to supplement any applicable Zoning Regulations and the City of Sidney Subdivision Regulations of the.

It is not the intent of this manual to take away from the designing engineer any responsibility for the technical adequacy of this design or freedom to use his engineering judgment and discretion. It is recognized that matters of engineering design cannot be set out in writing to cover all situations, however, the design standards as set out herein represent good engineering practice. Any design methods or criteria different than that listed will receive consideration for approval, provided the proposed variances and the reasons for their use are submitted to the City.

The City, at any time during design or construction, shall have the authority to modify any engineering or construction detail, whenever required for the protection of the public interest.

Though the City has no jurisdiction in areas outside of the City limits, the City strongly recommends that any development constructed within close proximity of the City be designed and constructed to these standards. This will help ensure that, if the development is brought into the City, the development will be accepted by the City without additional upgrades.

The City, at their discretion, may request that infrastructure and utility facilities in any particular development be installed to accommodate future expansion within the City. If this is requested, the City will evaluate the Developer's eligibility to be compensated for the cost difference to oversize particular infrastructure items per the Subdivision Regulations of the City.

REFERENCES

The City of Sidney Design Criteria and Construction Standards and Drawings are to be used to supplement the following references. Whenever there are differences in these references and the Design Criteria and Construction Standards and Drawings, the more restrictive or higher standard shall apply as determined by the City.

- Ohio Department of Transportation (ODOT), latest versions
  - ⇒ Construction and Material Specifications
  - ⇒ Location and Design Manuals
    - Volume 1 - Roadway Design
    - Volume 2 - Drainage Design
  - ⇒ Standard Construction Drawings
  - ⇒ Standard Design Drawings
  - ⇒ Supplemental Specifications
  - ⇒ Traffic Control for Uniform Control Devices

- American Association of State Highway and Transportation Officials (AASHTO), latest version
  - ⇒ A Policy on Geometric Design of Highways and Streets

- Great Lakes Upper Mississippi River Board (GLUMRB) (Ten State Standards), latest version
  - ⇒ Recommended Standards for Wastewater Facilities
  - ⇒ Recommended Standards for Water Works

100.00 GENERAL PROVISIONS

100.01 General

A. The Design Criteria and Construction Standards and Drawings along with 100% performance surety and 10% maintenance surety shall apply to all public improvement construction projects that will eventually be taken over by the City of Sidney. The 100% performance surety and 10% maintenance surety shall follow the regulations in the City of Sidney Subdivision Regulations even if the improvements are not part of a major subdivision.

B. The Developer/Owner shall design and construct improvements not less than the standards outlined in the City of Sidney's Subdivision Regulations and this document. The work shall be done under City supervision and shall be completed within the time fixed or agreed upon by the City of Sidney.

C. It is the responsibility of the Developer/Owner and his engineer to investigate local conditions that may require additional improvements.

D. In the event any conflicting standards are encountered, the more restrictive shall apply as determined by the City of Sidney.

E. Upon request of the Developer/Owner or his representative, the City will evaluate requests to provide open excavation of existing utilities to allow accurate elevation information.

100.02 Construction Procedures and Materials

A. PRE-CONSTRUCTION MEETING

A pre-construction meeting with the City is required. The Developer/Owner, his contractor, his engineer, and representatives from utility companies involved shall be present at the meeting. It shall be the Developer/Owner's responsibility to arrange the preconstruction meeting.

B. MATERIALS

All work and materials shall conform to the Ohio Department of Transportation (ODOT) Construction and Material Specifications and the Construction Standards and Drawings of the City of Sidney, Ohio.

C. INSPECTIONS

1. Periodic inspection during the installation of improvements shall be made by the City to ensure conformity with the approved plans and specifications as required by these and other regulations. The Developer/Owner shall notify proper administrative

officials at least 24 hours before each phase of the improvement is ready for inspection. The primary contact for all inspections shall be the City Engineering Department at (937) 498-8142.

Inspections shall be at a minimum as follows:

a) Sanitary Sewer
   1) Sanitary pipe and manhole installation
   2) Lateral location and inspection of all sewers
   3) Proper backfill installation
   4) Air test sanitary lines
   5) Vacuum test manholes
   6) Deflection test on PVC sewers

b) Water Main
   1) Pipe installation
   2) Hydrant installation
   3) Valve installation
   4) Service installation
   5) Proper backfill installation
   6) Restraining glands and/or blocking installation
   7) Pressure test
   8) Disinfection
   9) Hydrant and valve operation (by Fire Department)
   10) Hydrant assembly location and grade (by Fire Department)

c) Storm Sewer
   1) Manhole and Catch Basin installation
   2) Storm sewer pipe installation
   3) Field tile connections
   4) Proper backfill installation
   5) Headwall installation

d) Roadway
   1) Street excavation operations
   2) Subgrade preparation
   3) Subgrade undercutting
   4) Subbase installation
   5) Curbing installation
   6) Sidewalk and approach installation
   7) Pavement installation

2. The absence or presence of an inspector during construction shall not relieve the Developer/Owner or contractor from full responsibility for compliance with plans, specifications, and City requirements.

3. Weight and delivery tickets shall be furnished to the City to substantiate the type, quantity, and size of material used.

D. RESPONSIBILITY

All work shall be under the control and supervision of the Developer/Owner until written final approval is given by the City.

E. FINAL INSPECTION

Upon completion of all the improvements, the Developer/Owner shall request, in writing, a final inspection by the City. The final inspection shall be performed by officials from the City with the Developer/Owner. The Developer/Owner's Engineer and the Developer/Owner's Contractor will be present.

F. UTILITY COORDINATION

Coordination of utility location/installation such as electric, gas, telephone, and cable television shall be the responsibility of the Contractor, Developer, or Owner in accordance with plans approved by the City.

CONSTRUCTION INSPECTION

PROJECT _____

DATE _____ INSPECTOR _____

This list could vary depending upon the types of construction included in the project. A typical list would require a 24-hour notice for inspections at the following points:

√	DESCRIPTION	REMARKS
A.	**PRIOR TO INSPECTION**	
	Review plans, special provisions, construction & materials manual & specifications that apply to your assigned duties.	
	Discuss your responsibility & authority with the project engineer.	
	Discuss notification, changes, connections, delays, rejections, and tolerances.	
B.	**PRE-CONSTRUCTION CONFERENCE**	
	Attendees: Owner/Administrator, Developer/Owner, his Contractor, his Engineer, and representatives from Utility Companies	
	Discuss phasing & schedules	
	Discuss materials	
	Discuss coordination	
	Discuss safety (public & job)	
	Discuss responsibilities	
C.	**SANITARY SEWER & LATERALS TO R/W**	
	Check pipe type & quality	
	Trench condition	
	Bedding	
	Proper initial backfill	
	Proper backfill	
	Prohibit groundwater from entering sanitary	
	Straight alignment & joints	
	Wye installation & location	
	Air test, mainline & laterals	
	Mandral test on PVC	

√	DESCRIPTION	REMARKS
D.	**SANITARY MANHOLE**	
	Check type & condition	
	Steps condition & alignment	
	Cone type & condition	
	Raisers recast/mastic	
	Casting - rim & lid	
	Proper pipe connection	
	Installation with O-rings	
	Installation on good base	
	Proper backfill, compacted granular under or near roadway	
	Vacuum test	
	Rim & risers to properly finish grade	
	Chimney Seal	
E.	**WATER MAIN**	
	Type & condition	
	Valve, type & condition	
	Hydrant, type & condition	
	Trench condition	
	Pipe alignment & joints	
	Air release valves	
	Isolation Valve installation & location	
	Hydrant assembly installation & location (by Fire Dept.)	
	Restrained as needed	
	Bedding	
	Initial backfill compacted granular	
	Proper backfill - compacted granular under or near roadway	
	Pressure test	
	Purification test	
	Valve & hydrant operation (by Fire Dept.)	
	Laterals: Corp Stop K-Copper Curb Stop	

√	DESCRIPTION	REMARKS
F.	**STORM SEWER**	
	Check pipe type, size, & quality	
	Check catch basin & grate type, size, & quality	
	Check manhole type, size, & quality	
	Trench condition	
	Bedding	
	Proper initial backfill	
	Proper backfill, compacted granular under or near roadway	
	Straight alignment & joint sealing	
	Proper connection to catch basin & manholes	
	C.B. set in good horizontal & vertical alignment with curbs	
	Slope & grade: Review control stakes & adjacent terrain for drainage	
	Field tile & other pipes reconnected & noted on plans	
G.	**ROADWAY**	
	Subgrade:	
	All topsoil removed in roadway	
	Compacted granular or clay fill only	
	Proper cross slope	
	Proper elevation	
	Free of roots, large stones, & excess dust	
	Proper compaction	
	Proofroll or density test, if soft undercut and/or underdrains	
	Measure elevation and cross slope	
	Subbase:	
	Proper material	
	Compacted in appropriate layers	
	Proofroll or density test, if soft undercut and/or tensar	
	Protect subgrade from being rutted or damaged	
	Proofroll subbase before prime coat	
	Measure elevation & cross slope	
	Surface; Pavement	
	Appropriate moisture & temperature conditions	
	Visual inspection of material (be aware of acceptable temperature range of mix & compensation)	
	Proper distribution & roller	
	Proper prime coat	

√	DESCRIPTION	REMARKS
G.	**ROADWAY (Cont.)**	
	Lay in proper layer	
	Watch joints, lapps, and around manholes, valves, etc.	
	Seal against concrete curbs, etc.	
	Measure elevation & cross slope	
	Keep traffic off for 24 hours, if possible	
	Pavement coring after base course asphalt is placed	
	Calculate any assessment for deficient asphalt and aggregate base	
	Surface; Concrete	
	Appropriate moisture and temperature conditions	
	Forms are set with reasonable conformance to grade & alignment	
	Forms are supported on thoroughly-compacted material	
	Appropriate consolidation of concrete	
	Check reinforcement	
	Check dowels	
	Check for expansion joints	
	Observe mix and placement	
	Observe finishing procedures	
	Needs curing as soon as possible	
	Observe saw joints	
	Note when forms are removed	
H.	**FIXED STRUCTURES, CURBS, SIDEWALK, HEADWALL, ETC.**	
	Check proper concrete mix	
	Appropriate moisture & temperature conditions	
	Check all underground portions	
	Check backfill, operation & material	
	Check subgrade, proofroll, or density check	
	Check subbase under curbs	
	Review requirements for reinforcing steel	
	Check all reinforcement	
	Check all dowels	
	Check for expansion joints	
	Be aware of time concrete was batched & allowable time for placement	
	Observe mix & placement	
	Observe finishing procedure	
	Needs curing material ASAP	
	If required, check cold weather protection	

√	DESCRIPTION	
H.	**FIXED STRUCTURES, CURBS, SIDEWALK, HEADWALL, ETC. (Cont.)**	
	Needs saw joints ASAP	
	Note when forms are removed	
	Backfill as soon as possible	
I.	**MISCELLANEOUS**	
	Keep daily logs	
	Pre-mark all existing utilities	
	Reconnect all existing utilities	
	Mark ends of all laterals in field (Contractor's responsibility)	
	Mark ends of all laterals on plans	
	Restoration	
	Grade to drain	
	Check trench settlement	
	Seeding & Mulching	
	Erosion Control	
	Inlets	
	Outlets	
	Curb lines	
	Ditches	
	Basins	
	Final check for debris & flow	
	Sanitary sewer	
	Storm sewer manhole & catch basin	
	Curb lines	

100.03 Submission of Plans

A. CONSTRUCTION DRAWINGS

1. Complete construction drawings on 24" x 36" vellum, 4 mil thickness, mylar film or other approved reproducible media and an 11" x 17" (1/2 scale) paper copy signed and approved by a registered engineer shall be made for all new streets, utilities and other improvements to be constructed in any development in the City. Said drawings are to be approved by the City before any construction may begin.

2. Plan line weights and style, topographic symbols, etc. shall conform to the plan requirements as established in ODOT's Location and Design Manual.

3. Submission of plans shall comply with Planning Commission regulations and the City of Sidney's Subdivision Regulations and Zoning Ordinance.

B. STANDARD TITLE BLOCK

All plan sheets shall display a standard title block containing the following:

1. Name, address, telephone number, and fax number (logo optional)
2. Plan sheet number
3. Development name
4. Sheet title
5. Date
6. Revision block
7. Drawn by
8. Checked by

C. REQUIRED PLAN LAYOUT ORDER

1. Title Sheet
2. Final Plat
3. Schematic Plan
4. Typical Sections
5. General Notes
6. General Details
7. Site Grading and Erosion Control Plan
8. Erosion Control Details
9. Miscellaneous Details (example: Pump Station, Intersection Plan)
10. Plan and Profile
11. Cross-Sections
12. Detention Basin Plan and Details
13. Off-Site Utilities Plan and Profile

1. TITLE SHEET

   a) Title of Project, City, County, Township, and State
   b) Index of sheets and sheet numbering
   c) Vicinity map with north arrow and project site call-out
   d) City of Sidney Construction Standards and Drawings reference
   e) Underground utilities note (O.U.P.S.)
   f) Signature and stamp
   g) Date of finished plans
   h) Project description
   i) Approval plan signatures of the City Engineer. The following statement shall be placed above the approval signature: "The City of Sidney signatures on this plan signify only concurrence with the general purpose and location of the proposed improvement. All technical details remain the responsibility of the Professional Engineer who prepared and certified these plans."
   j) Name, address, telephone number, and fax number of firm that prepared plans.

2. FINAL PLAT

   a) Copy of approved final plat with signatures
   b) See Subdivision Regulations

3. SCHEMATIC PLAN - LARGE SCALE LAYOUT OF SITE

   a) At a measurable scale to show the whole site on one sheet (max. scale 1" = 100').
   b) Show existing and proposed right-of-way, property lines and roadway, lot numbers, street names, existing adjoining property lines, and owners.
   c) Show proposed utilities and numbering of sanitary and storm manholes and catch basins.
   d) Stationing of intersections and streets.
   e) Multi-baseline legend (street number, stationing, description, etc.)
   f) North arrow and scale.
   g) Benchmarks and locations.
   h) Centerline stationing.
   i) Overall plan view of the development depicting the layout of the proposed sanitary sewer, water, and drainage network. Plans should include all manholes, pipes, other structures, and the plan and profile sheet on which they are located.
   j) Plan and Profile Sheet reference.

4. TYPICAL SECTIONS

   a) Detailed labeling.
   b) Legend of pavement composition.
   c) Limiting stations for each section.

d) Dimensioning, pavement, curb and gutter, curb lawn, sidewalk, right-of-way, and pavement slopes.

5. GENERAL NOTES

All notes necessary for construction which are not defined clearly elsewhere within the plans.

6. GENERAL DETAILS

a) All details necessary for construction except those City of Sidney Construction Standards and Drawings referenced on the title sheet.
b) Modified City of Sidney Construction Standards and Drawings shall be redrawn for approval.

7. SITE GRADING PLAN AND EROSION CONTROL

Site Grading Plan

a) A final site grading plan must be included with the construction drawings and approved by the City.
b) Proposed 1' contours showing all lots having proper drainage.
c) Proposed building pad elevation.

Storm Water Pollution Prevention Plan

A Storm Water Pollution Prevention Plan will be required to be included with construction drawings and approved by the City. This plan shall follow OEPA and NPDES permit requirements and shall be submitted to and approved by the OEPA prior to construction.

a) Show and label existing and proposed 1' contours.
b) Proposed storm manholes, catch basins, pipes, etc., labeled and numbered.
c) Concentrated flows.
d) Property lines and rights-of-way, lot numbers and property owners.
e) Proposed/existing roadways.
f) Proposed diversions and erosion control (Example: diversion ditches, fabric fence, straw bales, sediment basin).
g) Erosion control construction sequence list.
h) Limits of grading.
i) Proposed storm sewer pipe flows and capacities.
j) Sediment basin location.
k) North arrow and scale.
l) At a measurable scale to show the whole site on one sheet (maximum scale 1" = 100').

8. EROSION CONTROL DETAILS

Any details necessary for construction except those City of Sidney Construction Standards and Drawings referenced on the title sheet.

9. MISCELLANEOUS DETAILS (Example: Pump Station, Intersection Plan, etc.)

Plans shall include a detailed drawing with all proper labeling and dimensioning.

10. PLAN AND PROFILE

a) The plan and profile shall be at a scale of 1" = 20' horizontal, 1" = 5' vertical.
b) Plan and profile sheets shall show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.
c) All grade elevations shall be based on U.S.G.S. and City of Sidney datum.
d) Plan and profile sheets will be required for all off-site utility extensions.
e) More specifically, all plans and profile sheets must show and include the following items:

10A <u>General - Plan</u>

a) Show all proposed lots, streets and curbs, etc.
b) Show all existing pavements, headwalls, piers, utilities, mailboxes, trees, etc. (existing infrastructure may be shown in lighter text and no less than 80% shading).
c) Typical street and curb sections.
d) Construction notes.
e) Structural details.
f) North arrow (preferably up or to the right) and scale (horizontal and vertical).
g) Street names.
h) Centerline stations and ticks every 100' (south to north and west to east where possible).
i) Easements for utilities and storm drainage.
j) Lot numbers, dimensions, and frontage.
k) Curb radius at intersections with back of curb elevations at quarter points (if not covered in separate intersection detail).
l) Curve data: radius, delta, chord length, chord bearing, arc length, station of PC, PT, PCC, PI, PRC.
m) Sheet reference.
n) Plat phase lines (boundary lines) show stations.
o) Dimension and station of utility locations.
p) Centerline bearings and/or intersecting centerline angles.
q) Final monument box callouts set at PC, PT, PCC, PI, PRC (in pavement) intersections.
r) Drive apron stationing and width callout.

s) Show all existing features within 50' of right-of-way.
t) Proposed electric, telephone, gas, cable locations, and easements.
u) Proposed light pole layout and electric feed.
v) Match lines with stationing.
w) Intersection elevation for proper storm water drainage.
x) Benchmarks

10B General - Profile

a) Existing centerline and proposed centerline profile.
b) Label proposed centerline grades (minimum grade 0.50%).
c) Show all mainline existing utilities.
d) Existing and proposed grade elevations every 25' (existing elevation on bottom of sheet and proposed elevation on top of sheet. Note as to centerline or top of curb.)
e) Show and label all vertical curves (Stations, elevations, length).

10C Storm Sewer - Plan

a) Show and station, with offsets, the proposed storm sewers: manholes, laterals, catch basins, headwalls, etc.
b) Label each pipe size and type.
c) Number proposed storm manholes and catch basins.

10D Storm Sewer - Profile

a) Show length of span, size, grade, and class and/or type of proposed pipe.
b) Label existing pipe size and type.
c) Existing and proposed storm.

    1) Label existing and proposed mainline storm water manholes, junction boxes, catch basins, etc., and show centerline of streets and stations of each.
    2) Show invert elevations of all pipe at manholes, headwalls, junction boxes, catch basins, etc.
    3) Show elevation on top of manhole or catch basin.
    4) Number proposed storm manholes and catch basins.

10E Water - Plan

a) Show and station with offsets the proposed waterline, laterals, deflection points, hydrants, valves, etc.
b) Label pipe size, tees, crosses, etc.
c) Station and offset above items.
d) Indicate the testing requirements for fire protection and water services.

10F Water - Profile

a) Show length, size, depth, and class and/or type of pipe.
b) Show deflection points.
c) Show stations and any critical elevations for above items.
d) Label minimum/maximum coverage of water main.

10G Sanitary Sewer - Plan

a) Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled.
b) Label each pipe size.
c) Number proposed sanitary manholes and cleanouts.
d) Proposed lateral locations.

10H Sanitary Sewer - Profile

a) Show length of span, size, grade, and class and/or type of proposed pipe.
b) Show existing sanitary.
c) Show invert elevation of all pipe at manholes.
d) Show top elevations of manholes.
e) Number proposed sanitary manholes and cleanouts.

11. CROSS-SECTIONS

a) The cross-sections shall be at a scale of 1" = 5' horizontal, 1" = 5' vertical.
b) Cross-sections shall be every 50' and at other critical areas.
c) Show all existing utilities with labels.
d) Show all proposed utilities with labels.
e) Show all proposed and existing roadway sections with existing and proposed centerline elevations.
f) Cross-section at each drive and intersection roadway (for reconstruction project and projects where drive locations are predetermined).

12. DETENTION BASIN PLAN AND DETAILS

Detailed site plan including inlet and outlet elevations, top of bank elevations, and emergency overflow elevations.

13. OFF-SITE UTILITIES PLAN AND PROFILE

Refer to Plan and Profile.

CONSTRUCTION PLANS
CHECKLIST

PROJECT _____ DATE _____

√	DESCRIPTION	REMARKS
	C. REQUIRED PLAN LAYOUT ORDER	
	Title Sheet	
	Final Plan	
	Schematic Plan	
	Typical Sections	
	General Notes	
	General Details	
	Site Grading and Erosion Control Plan	
	Erosion Control Details	
	Misc. Details (e.g. pump station, intersection plan)	
	Plan and Profile	
	Cross-Sections	
	Detention Basin Plan and Details	
	Off-Site Utilities Plan and Profile	
	GENERAL	
	Acceptable natural drainage and erosion control	
	Right-of-way widths meet minimum criteria	
	Pavement widths	
	Radius of curvature	
	Horizontal visibility	
	Vertical alignment and visibility	
	Grades	
	Cul-de-sacs	
	Turn around radius, right-of-way, and pavement	
	Dead-end streets	
	Alignment of intersection	
	Space of intersection relative to difference in road classifications	
	Avoidance of multiple intersection	
	Pavement and right-of-way of intersection	
	Streets for commercial developments	
	Repair of pavements	

√	DESCRIPTION	REMARKS
	GENERAL (Cont.)	
	Streets for industrial development	
	Lengths of blocks meet minimum criteria	
	Crosswalks	
	Street Monuments	
	Subgrade	
	Base Course	
	Surface Course	
	Grading Plan	
	Storm drainage system type	
	Manholes	
	Catch basins	
	Headwalls	
	Sufficient easements for utilities or open drainage	
	Other utilities	
	Underground utilities	
1.	**TITLE SHEET**	
	Title of Project, City, County, Township, and State	
	Index of sheets and sheet numbering	
	Vicinity map with north arrow and project site callout	
	City of Sidney Construction Standards and Drawings reference	
	Underground utilities note (O.U.P.S.)	
	Signature and stamp	
	Date of finished plans	
	Project description	
	Approval plan signatures	
	Name, address, telephone number, and fax number of firm that prepared plans	
2.	**FINAL PLAT**	
	Copy of approved final plat with signatures	
	See Subdivision Regulations	

√	DESCRIPTION	REMARKS
3.	**SCHEMATIC PLAN - LARGE SCALE LAYOUT OF THE SITE**	
	At a measurable scale to show the whole site on one sheet (max. scale 1" = 100').	
	Show existing and proposed right-of-way, property lines and roadway, lot numbers, street names, existing adjoining property lines and owners.	
	Show proposed utilities and numbering of sanitary and storm manholes and catch basins.	
	Stationing of intersections and streets.	
	Multi-baseline legend (street number, stationing, description, etc.).	
	North arrow and scale.	
	Benchmarks and locations.	
	Centerline stationing.	
	Overall plan view of the development depicting the layout of the proposed sanitary sewer and drainage network. Plans should include all manholes, pipes, other structures, and the plan and profile sheet on which they are located.	
	Plan and Profile sheet reference	
4.	**TYPICAL SECTIONS**	
	Detailed labeling.	
	Legend of pavement composition.	
	Limiting stations for each section.	
	Dimensioning, pavement, curb and gutter, curb lawn, sidewalk, right-of-way, and pavement slopes.	
5.	**GENERAL NOTES**	
	All notes necessary for construction which are not defined clearly elsewhere within the plans.	
6.	**GENERAL DETAILS**	
	All details necessary for construction except those City of Sidney Constructions Standards and Drawings referenced on title sheet.	
	Modified City of Sidney Construction Standards and Drawings shall be redrawn for approval.	

√	DESCRIPTION	REMARKS
7.	**SITE GRADING PLAN AND EROSION CONTROL**	
	A final site grading plan must be included with the construction drawings and approved by the City.	
	Proposed 1' contours showing all lots having proper drainage.	
	Proposed building pad.	
	A Storm Water Pollution Prevention Plan will be required to be included with the construction drawings and approved by the City. This plan shall follow the OEPA and NPDES permit requirements and shall be submitted to and approved by the OEPA prior to construction.	
	Show and label existing and proposed 1' contours.	
	Proposed storm manholes, catch basins, pipes, etc., labeled and numbered.	
	Concentrated flows.	
	Property lines and rights-of-way, lot numbers, and property owners.	
	Proposed/existing roadways.	
	Proposed diversions and erosion control (e.g. diversion ditches, fabric fence, straw bales, sediment basins.)	
	Erosion control construction sequence list.	
	Limits of grading.	
	Proposed storm sewer pipe flows and capacities.	
	Sediment basin location.	
	North arrow and scale.	
	At a measurable scale to show the whole site on one sheet. (Maximum scale 1" = 100')	
8.	**EROSION CONTROL DETAILS**	
	Any details necessary for construction except those City of Sidney Construction Standards and Drawings referenced on title sheet.	
9.	**MISC. DETAILS (e.g. pump station, intersection plan, etc.)**	
	Plans shall include a detailed drawing with all proper labeling and dimensioning.	

√	DESCRIPTION	REMARKS
10.	**PLAN AND PROFILE**	
	Use a scale of 1" = 20' horizontal, 1"=5' vertical.	
	Show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.	
	All grade elevations shall be based on U.S.G.S. and City of Sidney datum.	
	Plan and profile sheets are required for all off-site utility extensions.	
10A	**GENERAL – PLAN**	
	Show all proposed lots, streets, and curbs, etc.	
	Show all existing pavements, headwalls, piers, utilities, mailboxes, trees, etc. (existing infrastructure may be shown in lighter text and no less than 80% shading).	
	Typical street and curb sections.	
	Construction notes.	
	Structural details.	
	North arrow (preferably up or to the right) and scale (horizontal and vertical).	
	Street names.	
	Centerline stations and ticks every 100' (south to north and west to east where possible).	
	Easements for utilities and storm drainage.	
	Lot numbers, dimensions, and frontage.	
	Curb radius at intersections with back of curb elevations at quarter points (if not covered in separate intersection detail).	
	Curve data: radius, delta, chord length, chord bearing, arc length, station of PC, PT, PCC, PI, PRC.	
	Sheet reference.	
	Plat phase lines (boundary lines) show stations.	
	Dimension and station of utility locations.	
	Centerline bearings and/or intersecting centerline angles.	
	Final monument box callouts set at PC, PT, PCC, PI, PRC (in pavement) intersections.	
	Drive apron stationing and widths callout.	
	Show all existing features within 50' of right-of-way.	

√	DESCRIPTION	REMARKS
	Proposed electric, telephone, gas, cable locations, and easements.	
	Proposed light pole layout and electric feed.	
	Match lines with stationing.	
	Intersection elevation for proper storm water drainage.	
	Benchmarks.	
10B	**GENERAL - PROFILE**	
	Existing centerline and proposed centerline profile.	
	Label proposed centerline grades (minimum grade 0.50%).	
	Show all mainline existing utilities.	
	Existing and proposed grade elevations every 25' (existing elevation on bottom of sheet and proposed elevation on top of sheet. Note as to centerline or top of curb.)	
	Show and label all vertical curves (stations, elevations, length).	
10C	**STORM SEWER - PLAN**	
	Show and station, with offsets, the proposed storm sewers: manholes, laterals, catch basins, headwalls, etc.	
	Label each pipe size and type.	
	Number proposed storm manholes and catch basins.	
10D	**STORM SEWER - PROFILE**	
	Show length of span, size, grade, and class and/or type of proposed pipe.	
	Label existing pipe size and type.	
	Label existing and proposed mainline storm water manholes, junction boxes, catch basins, etc., and show centerline of streets and stations of each.	
	Show invert elevations of all pipe at manholes, headwalls, junction boxes, catch basins, etc.	
	Show elevation on top of manhole or catch basin.	
	Number proposed storm manholes and catch basins.	

√	DESCRIPTION	REMARKS
10E	**WATER - PLAN**	
	Show and station, with offsets, the proposed waterline, laterals, deflection points, hydrants, valves, etc.	
	Label pipe size, tees, crosses, etc.	
	Station and offset above items.	
	Indicate the testing requirements for fire protection and water services.	
10F	**WATER - PROFILE**	
	Show length, size, depth, and class and/or type of pipe.	
	Show deflection points.	
	Show stations and any critical elevations for above items.	
	Label minimum/maximum coverage of water main.	
10G	**SANITARY SEWER - PLAN**	
	Show sanitary sewers, manholes, laterals, cleanouts, etc. with station and offset labeled.	
	Label each pipe size.	
	Number proposed sanitary manholes and cleanouts.	
	Proposed lateral locations.	
10H	**SANITARY SEWER - PROFILE**	
	Show length of span, size, grade, and class and/or type of proposed pipe.	
	Show existing sanitary.	
	Show invert elevation of all pipe at manholes.	
	Show top elevations of manholes.	
	Number proposed sanitary manholes and cleanouts.	
11.	**CROSS-SECTIONS**	
	Cross-sections shall be at a scale of 1”=5’ horizontal, 1”=5’ vertical.	
	Cross-sections shall be every 50’ and at other critical areas.	
	Show all existing utilities with labels.	
	Show all proposed utilities with labels.	
	Show all proposed and existing roadway sections with existing and proposed centerline elevations.	
	Cross-section at each drive and intersection roadway (for reconstruction projects and project where drive locations are predetermined).	

√	DESCRIPTION	REMARKS
12.	**DETENTION BASIN**	
	Detailed site plan including inlet and outlet elevations, top of bank elevations and emergency overflow elevations.	
13.	**OFF-SITE**	
	Refer to Plan and Profile.	

100.04 Record Drawings (As-Builts)

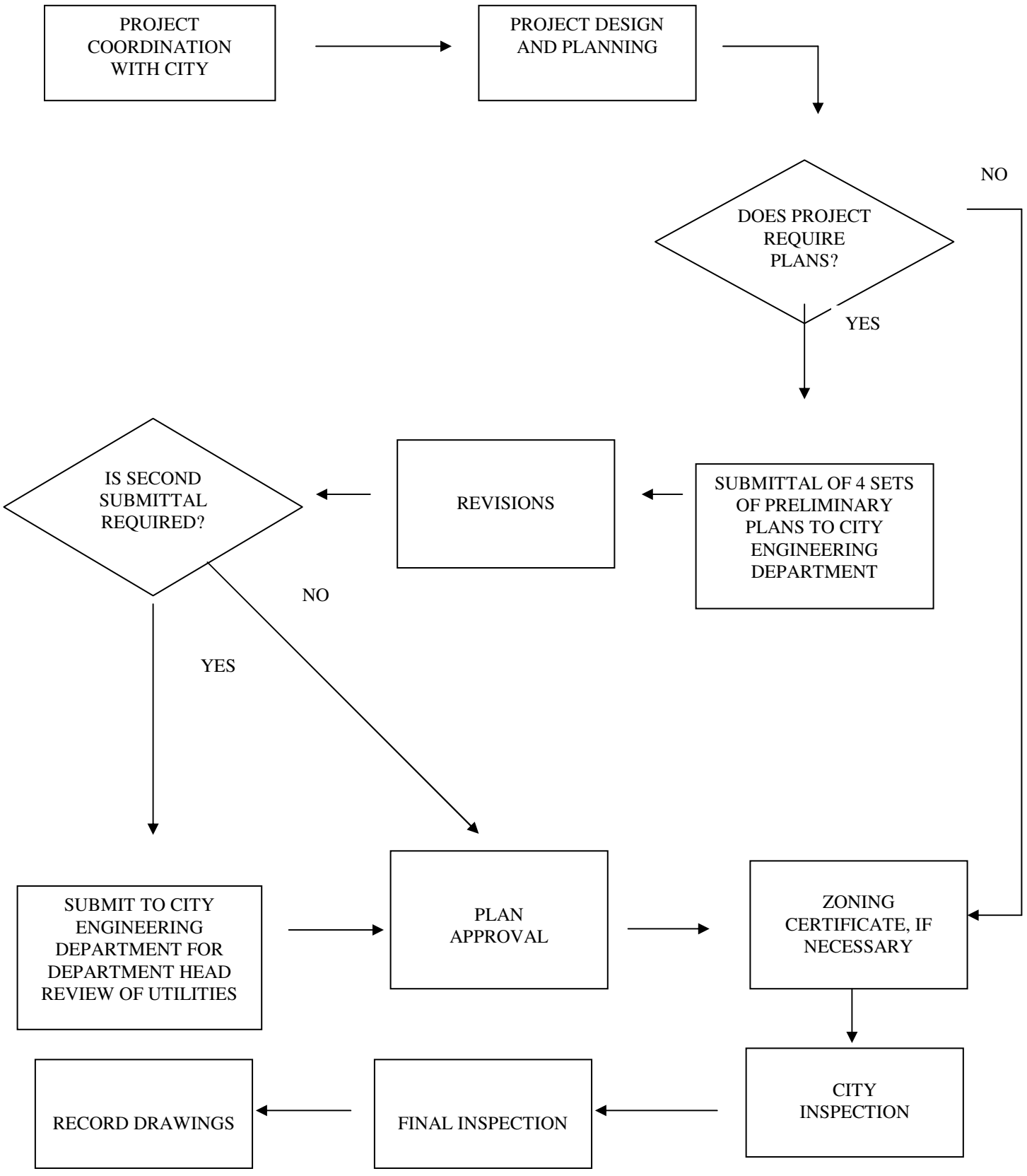
A. Record Drawings (As-Builts) Requirements

1. At the completion of construction, the original tracings shall be revised as necessary to provide "Record Drawings". This work shall be done by the Developer/Owner's Engineer, who was responsible for setting grades and staking for improvements. The "Record Drawings" shall include the following information:

   a) Location of all water and sanitary services as well as storm outlets if provided.
   b) Final elevations and locations of the following:
      1) Storm sewer inlets, outlets, and manholes with all inverts
      2) Drainage swales, detention basins including structures with all elevations and capacity recalculated
      3) Sanitary sewer manholes and inverts and lateral locations
      4) Curb, gutter, and centerline elevations at locations where they are ended for future roadway extensions.
   c) The location of any additional improvements, construction as additions, or changes to the approved plans, such as tapping sleeves, blind taps, joint clamps, or any other field change item.
   d) The original tracings and a copy of the revised computer drawings transferable to electronic media downloadable by the City.

2. Maintenance Surety shall not be released until satisfactory Record Drawings (As-Builts) are delivered to the City.

100.05 Plan Review and Approval Process



200.00 DEFINITIONS

Interpretation of Terms or Words

Regardless of capitalization, definitions are standard for the intent of these Design Criteria.

AASHTO
American Association of State Highway and Transportation Officials

ANSI
American National Standards Institute

ASCE
American Society of Civil Engineers

ASTM
American Society for Testing and Materials

AVERAGE DAILY FLOW
The total quantity of liquid tributary to a point divided by the number of days of flow measurement.

AWWA
American Water Works Association

BEDDING
The earth or other materials on which a pipe or conduit is supported.

BUILDING SEWER
A pipe conveying wastewater from a single building to a common sewer or point of immediate disposal.

CATCH BASIN
A structure intended to collect surface runoff and direct it into the storm sewer system.

COLLECTOR SEWER
A sewer normally less than 15 inches in diameter that receives wastewater from the sanitary laterals and transports it to the interceptor sewer.

COMBINED SEWER
A sewer intended to receive both wastewater and storm or surface water.

CROSS-CONNECTION

A. A physical connection through which a supply of potable water could be contaminated or polluted.
B. A connection between a supervised potable water supply and an unsupervised supply of unknown portability.

CULVERT
A structure which allows surface runoff to flow through a roadway fill or similar obstruction of open flow. Culverts may be corrugated metal pipe, reinforced concrete, etc.

CURB INLET
A specialized catch basin (see catch basin) designed to collect runoff from pavement with curbing.

DESIGN STORM
The expected frequency of the storm for which the capacity of a structure will be equaled or exceeded. The capacity of a storm sewer designed for a 10-year design storm has a 1 in 10 chance of being equaled or exceeded in any given year.

DETENTION/RETENTION
The term detention/retention basin refers to the use of a storm water storage facility which will store storm water and release it at a given rate. The objective of a detention/retention facility is to regulate the rate of runoff and control the peak discharges to reduce the impact on the downstream drainage system.

Type of Storm Water Storage Facilities:

A. Detention Basin or Dry Basin - Dry basins are surface storage areas created by constructing a typical excavated or embankment basin.

B. Retention Basins or Ponds - Retention basins are permanent ponds where additional storage capacity is provided above the normal water level.

C. Parking Lot Storage - Parking lot storage is a surface storage facility where an inlet is undersized causing shallow ponding to occur in specific graded areas of the parking lot.

D. Subsurface Storage - Subsurface storage is a structure constructed below grade for the specific purpose of detaining storm water runoff.

DISCHARGE
The amount of flow carried by a culvert or storm sewer, normally measured in cubic feet per second.

DRAINAGE AREA
The area, in acres, which drains to a particular catch basin, culvert, or similar structure.

DROP MANHOLE
A manhole installed in a sewer where the elevation of the incoming sewer considerably exceeds that of the outgoing sewer; a vertical waterway outside the manhole is provided to divert the wastewater from the upper to the lower level so that it does not fall freely into the manhole except at peak rate of flow.

EARTH-DISTURBING ACTIVITY
Any grading, excavating, filling or other alteration of the earth's surface where natural or manmade ground cover is destroyed and which may result in or contribute to erosion and sediment pollution.

ENERGY GRADIENT
The slope of the energy line of a body of flowing water with reference to a datum plane.

ENERGY GRADIENT LINE
The line representing the gradient which joins the elevation of the energy head.

ENERGY HEAD
The height of the hydraulic grade line above the centerline of a conduit plus the velocity head of the mean velocity of the water in that section.

ENERGY LINE
A line joining the elevation of the energy heads; a line drawn above the hydraulic grade line by a distance equivalent to the velocity head of the flowing water at each section along a stream, channel, or conduit.

EROSION

A. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

B. Detachment and movement of soil or rock fragments by wind, water, ice, or gravity.

C. Erosion includes:

1. Accelerated erosion: Erosion much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of the activities of man.

2. Floodplain erosion: Abrading and wearing away of the nearly level land situated on either side of a channel due to overflow flooding.
3. Gully erosion: The erosion process whereby water accumulates in narrow channels during and immediately after rainfall or snow or ice melt and actively removes the soil from this narrow area to considerable depths such that the channel would not be obliterated by normal smoothing or tillage operations.
4. Natural erosion (geological erosion): Wearing away of the earth's surface by water, ice, or other natural environmental conditions of climate, vegetation, etc., undisturbed by man.
5. Normal erosion: The gradual erosion of land used by man which does not greatly exceed natural erosion.
6. Rill erosion: An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed soils.
7. Sheet erosion: The removal of a fairly uniform layer of soil from the land surface by wind or runoff water.

EXFILTRATION
The quantity of wastewater which leaks to the surrounding ground through unintentional openings in a sewer. Also, the process whereby this leaking occurs.

FIRE HYDRANT
A fixture installed throughout water distribution systems to provide water for fire-fighting needs.

GRASSED WATERWAY
A broad or shallow natural course or constructed channel covered with erosion-resistant grasses or similar vegetative cover and used to conduct surface water.

HEADWALL
A structure placed at the ends of a culvert to prevent movement of the culvert and reduce erosion.

HEADWATER
The vertical distance from a culvert invert at the entrance to the water surface upstream from the culvert.

INFILTRATION
The discharge of ground waters into sewers, through defects in pipe lines, joints, manholes, or other sewer structures.

INFILTRATION/INFLOW
A combination of inflow wastewater volumes in sewer lines with no way to distinguish either of the two basic sources, and with the same effect as surcharging capacities of sewer systems and other sewer system facilities.

INFLOW
The discharge of any kind of water into sewer lines from such sources as roof leaders, cellars, sump pumps and yard-area drains, foundation drains, commercial and industrial so-called "clean water" discharges, drains from springs and swampy areas, etc. It does not "infiltrate" the system and is distinguished from such wastewater discharge, as previously defined.

INLET CONTROL
A situation where the discharge capacity of a culvert is controlled at the culvert entrance by the depth of headwater and the entrance geometry, including the area, shape, and type of inlet edge.

INTERCEPTOR SEWER
A sewer which receives the flow from collector sewers and conveys the wastewater to treatment facilities.

JOINTS
The means of connecting sectional lengths of storm sewer pipe into a continuous sewer line using various types of jointing materials with various types of pipe formation.

JURISDICTION
Any governmental entity, such as town, city, county, sewer district, sanitary district or authority, or other multi-community agency which is responsible for and operates sewer systems, pumping facilities, regulator-overflow structures, and wastewater treatment works.

MAIN
The large water-carrying pipe to which individual user services are connected. Mains are normally connected to each other in a grid type system.

MANHOLE
An opening in a sewer provided for the purpose of permitting a person to enter or have access to the sewer.

MANNING ROUGHNESS COEFFICIENT
The roughness coefficient in the Manning Formula for determination of the discharge coefficient in the Chezy Formula. Roughness coefficient (n) of channel is based on actual tests typically provided in standard tables.

METER
The flow-measuring device installed at each service on a distribution system to measure the amount of water consumed by users at that service.

NORMAL DEPTH
The depth at which water will flow in a pipe or channel by virtue of its slope and roughness, based on the Manning Formula.

OEPA
Ohio Environmental Protection Agency.

OUTLET CONTROL
A situation where the discharge capacity of a culvert is controlled by the barrel of the culvert, rather than the inlet.

OVERFLOW
A pipe line or conduit device, together with an outlet pipe, which provides for the discharge of a portion of sewer flow into receiving water or other points of disposal.

PEAK
The maximum quantity that occurs over a relatively short period of time. Also called peak demand or peak load.

RAINFALL INTENSITY
The amount of rain falling over a specified period of time. Rainfall intensity is usually measured in inches per hour.

RATIONAL FORMULA
The method used to determine the amount of runoff from a specified area of known surface characteristics.

RUNOFF COEFFICIENT
A coefficient used in the Rational Formula to express the ratio of runoff to rainfall.

SANITARY WASTEWATER

A. Domestic wastewater with storm and surface water excluded.

B. Wastewater discharging from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, industrial plants, or institutions.

C. The water supply of a community after it has been used and discharged into a sewer.

SEDIMENT

Solid material both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by wind, water, gravity, or ice, and has come to rest on the earth's surface above or below sea level.

SEDIMENT BASIN
Barrier, dam, or other suitable detention facility built across an area of waterflow to settle and retain sediment carried by the runoff waters.

SEDIMENT CONTROL PLAN
A written description, acceptable to the approving agency, of methods for controlling sediment pollution from accelerated erosion on a development area of 5 or more contiguous acres or from erosion caused by accelerated runoff from a development area of 5 or more contiguous acres.

SEDIMENT POLLUTION
Wind or water erosion of the soil or the degradation of the waters of the state by soil sediment in conjunction with land grading, excavating, filling, or other soil-disturbing activities on land used or being developed for commercial, industrial, residential, or other purposes.

SERVICE
The pipe carrying water to individual houses or other users on a distribution system.

TAILWATER
The vertical distance from a culvert invert at the outlet to the water surface downstream from the culvert.

TIME OF CONCENTRATION
The time required for water to flow from the hydrologically remote point of a basin to the outlet or collection point being analyzed. The time of concentration is the maximum time for water to travel through the watershed, which is not always the maximum distance from the outlet to any point in the watershed. The time of concentration for all drainage design for areas larger than 20 acres should be computed using the TR-55 method. A sample calculation sheet is provided in Figure 6.2 Time of Concentration Worksheet. For smaller areas, Figure 6.4 Roughness Coefficient for TR-55 Sheetflow may be used.

WATER RESOURCE
Any natural or unnatural body of water, swale, ditch, conduit, pond, lake, etc. that receives or transports storm water runoff.

300.00 ROADWAYS

300.01 General

All street design and layout shall follow the City of Sidney Construction Standards and Drawings, the Ohio Department of Transportation (ODOT) Location and Design Manual, Volume One, Roadway Design, latest version, and AASHTO. The most restrictive shall apply as determined by the City Engineering Department. These criteria cover design factors and provide guidelines for evaluations of plans and specifications by the City department having jurisdiction over the review of the plans and specifications. The design shall be consistent with the requirements of AASHTO and ODOT.

600.00 STORM DRAINAGE

600.01 General

The following design criteria are summarized herein to establish practical uniform design of storm sewers for the City. The City has established a Comprehensive Storm water Management Code, City Ordinance A-1947, that will also be followed for the purpose of administrating, applying, and specifying the design criteria of storm water drainage and waterways. These criteria cover design factors and provide guidelines for evaluation of plans and specifications by the City department having jurisdiction over the review of plans and specifications. These design criteria are also intended to conform to the standard drawings for storm sewers. Storm sewer design should follow these criteria first and secondly the Ohio Department of Transportation Location and Design, Volume Two, Drainage Design, if appropriate. A copy of the OEPA Notice of Intent (NOI) is to be supplied upon submittal.

600.02 Adequate Drainage Outlet

Surface water runoff from a development shall be drained offsite in accordance with the City of Sidney Design Criteria and Construction Standards and Drawings to an adequate outlet(s). The City Engineer shall approve the location of the outlet(s). The outlet(s) may consist of a ditch, stream, storm sewer, excluding a field tile, or approved detention basin having sufficient capacity to accommodate the surface water runoff in a reasonable manner that does not cause erosion or degradation of existing facilities. The Developer shall submit in writing evidence indicating the adequacy of the outlet(s) to at least and through the first drainage structure offsite of the proposed improvement. The City Engineer shall review and determine the adequacy of the drainage outlet and reserves the right to require the outlet(s) to be cleaned, reconstructed, and/or replaced as deemed necessary.

An adequate outlet is defined as an outlet functioning as designed and able to carry the existing flows as well as the proposed flows in the post development condition. Even though the discharge rate is controlled to the 5-year storm, these are often concentrated flows.

The lack of an adequate drainage outlet may be cause for disapproval of the plan.

600.03 Storm Water Plan

In accordance with the Storm Water Management Code, Ordinance A-1947, submittals of the proposed detention/retention calculations, discharge erosion control measures and the pipe network flows are required for approval of the developed land. The following lists are the required submittals:

A. DETENTION/RETENTION BASIN CALCULATIONS

See calculation storage charts – Figure 6.5a through Figure 6.5g. Design criteria is covered in more detail in Section 600.17. Impervious by the City Zoning Districts – see Table 6.4.

B. PIPE NETWORK FLOWS

Provide a drainage plan of the proposed site as specified in Section 919.18 of the Storm water Management Code, City Ordinance A-1947. Provide calculations for Figure 6.4. See Tables 6.1, 6.2, and Figures 6.1, 6.2, and 6.3. Application for excavation/grading permit (if-needed) Sections 919.16 and 919.17 of the Storm Water Management Code, City Ordinance A-1947.

600.04 Storm Sewer and Inlet Grate Design

An adequate storm drainage system shall be constructed for all proposed developments. Natural drainage areas should be closely followed.

Outlets for the storm water runoff for development upstream of the proposed developments must be provided. All storm sewer calculations must be submitted to the City before any approvals will be given.

Storm runoff from urban areas may constitute a large volume of flow. The rational method is the preferred method for estimating storm runoff for areas less than or equal to 200 acres. Once the runoff is determined, the Manning Formula is the preferred method to calculate the capacity of the storm sewer pipes. Storm sewer shall be designed based on the full flow capacity of all pipes being able to carry at least the runoff from a 5-year storm event.

Also, the Hydraulic Grade Line (HGL) should be checked to ensure that a 25-year storm event will not cause ponding water at catch basins and manholes.

The Rational Formula used to compute the runoff that reaches a storm sewer inlet consists of the following:

$$Q = CiA$$

Q = Peak rate of runoff in cubic feet per second (cfs)
C = A coefficient expressing the ratio of runoff to the average rainfall rate during the time of concentration
i = Intensity of rainfall, in inches per hour
A = Drainage area, in acres

The drainage area(s) (watershed area) shall be determined by a review of, but not limited to, the sources listed below. Watershed area(s) are subject to the approval of the City Engineer. Existing watershed boundaries shall be maintained.

1. Contour Map: U.S. Geological Survey quadrangle (7.5 minute series) maps or other topographic contour map

2. Field investigation

3. Soil Survey of Shelby County, Ohio, USDA

4. Others approved for use by the City Engineer

Other methods for determination of peak runoff rates may be used upon approval from or by request of the City Engineer.

TABLE 6.1
RUNOFF COEFFICIENT - C

Predominant Land Use	
Business:	
Downtown Area	.80
Neighborhood Area	.70
Residential:	
Single-Family Areas	.40
Multi-Family Areas	.60
Industrial:	
Light Areas	.70
Heavy Areas	.80
Parks, Cemeteries	.30
Playgrounds	.35
Railroad Yard Areas	.35
Row Crops or Open Land	.25
Surface Characteristics	
Street:	
Asphalt	.90
Concrete	.90
Drives and Walks	.90
Roofs	.85
Lawns	
Flat -- 2% or less	.25
Average -- 2% to 7%	.35
Steep -- 7% or greater	.40

Table 6.1

Lists values of "C" for several land uses and surface characteristics. If more than one land use is present in a particular drainage area, a composite "C" value should be computed to represent the site.

Figure 6.1
Time of Concentration Worksheet
(to be utilized when overland flow is less than 1,000 feet)

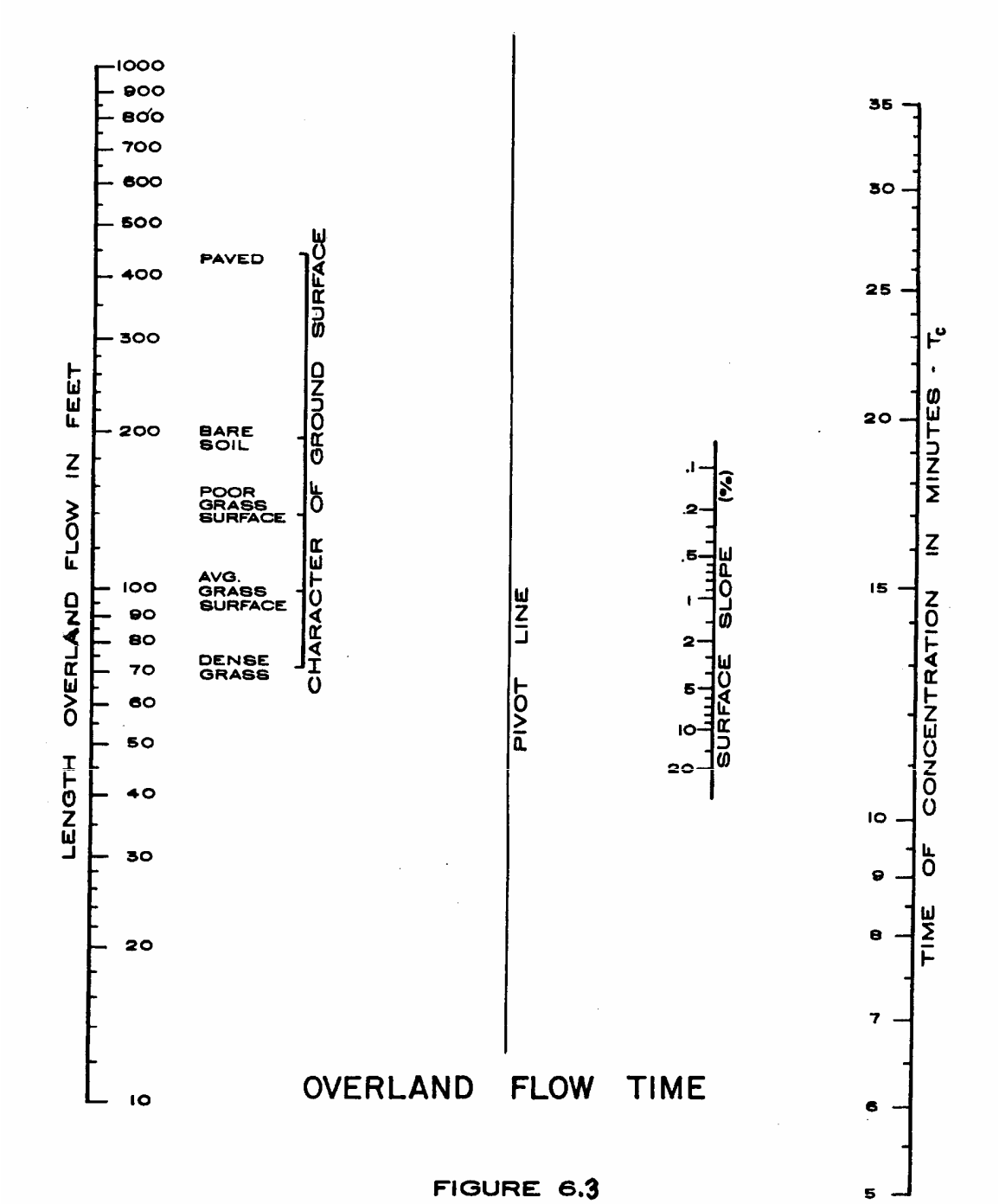


FIGURE 6.3

Figure 6.2
Time of Concentration Worksheet, Derived from TR-55
(to be utilized when overland flow is greater than 1,000 feet)

Project: _____ By: _____ Date: _____
Location: _____ Checked: _____ Date: _____
Circle one: Present Developed _____
Circle one: T_c T_t through subarea _____
NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Overland (Sheet) flow (Applicable as part of T_c computation only) Segment ID					
1. Surface description: paved or unpaved					
2. Manning's roughness coeff., n (See Figure 6.3)					
3. Flow length, L (total L≤ 300 ft for unpaved, L≤ 100 ft for paved)..... ft					
4. Two-yr 24-hr rainfall, P_2 ..... in	2.16	2.16			
5. Land slope, s .....ft/ft					
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t .....hr		+		=	
Shallow concentrated flow Segment ID					
7. Surface description: paved or unpaved					
8. Flow length, L..... ft					
9. Watercourse slope, s .....ft/ft					
10. Average velocity, $V_{unpaved} = 16.1345(s)^{0.5}$, or $V_{paved} = 20.3282(s)^{0.5}$. ft/s					
11. $T_t = \frac{L}{3600\,V}$ Compute T_t..... hr		+		=	
Channel flow Segment ID					
12. Cross sectional flow area, a .....ft^2					
13. Wetted perimeter, p_w..... ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... ft					
15. Channel slope, s .....ft/ft					
16. Manning's roughness coeff., n.....					
17. $V = \frac{1.49\, r^{2/3} s^{1/2}}{n}$ Compute V ..... ft/s					
18. Flow length, L..... ft					
19. $T_t = \frac{L}{3600\,V}$ Compute T_t..... hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)..... hr					

Figure 6.3

Surface Description	n[1] Coeff.
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover < = 20%	0.06
Residue cover > = 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Source: *TR-55, Urban Hydrology for Small Watersheds,* U.S. Dept. of Agriculture, Soil Conservation Service, Engineering Division, June 1986.

Table 6.2 - Intensity – Duration – Frequency Table

Hours	Minutes	Return Frequency – Rainfall Intensity (in/hr)					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
.08	5*	4.15	5.54	6.25	7.12	7.82	8.54
.17	10	3.35	4.51	5.08	5.87	6.20	6.97
.25	15	2.90	3.81	4.37	5.08	5.57	6.08
.33	20	2.50	3.29	3.81	4.46	4.80	5.36
.50	30	1.86	2.54	2.97	3.50	3.86	4.28
.75	45	1.40	1.88	2.20	2.60	2.88	3.22
1	60	1.12	1.52	1.78	2.10	2.34	2.61
2	120	0.68	0.91	1.08	1.27	1.42	1.55
3	180	0.50	0.675	0.80	0.94	1.05	1.16
6	360	0.30	0.40	0.48	0.56	0.62	0.68
12	720	0.16	0.23	0.27	0.37	0.36	0.39
24	1440	0.09	0.13	0.15	0.18	0.20	0.22

* Minimum Time of Concentration
** Interpolation is acceptable to obtain values not provided in the above table.

Table 6.2

This can be used to determine values of "I" for several storm frequencies.

The Manning Formula, used to compute flow in open conduits, consists of the following:

$$Q = \frac{1.486}{n} R^{2/3} S^{1/2} A$$

Q = Flow in cubic feet per second (cfs)
n = Coefficient of conduit roughness (n = 0.013)
R = Hydraulic radius, ratio of flow area to wetted perimeter in feet
S = Channel or pipe slope, in feet per feet
A = Area of cross-section of flow in square feet

The design of storm sewers in the City shall be outlined as follows:

A. Prepare a contour map of the drainage area including the surrounding area, drainage limits, and direction of surface flow.

B. Divide the area into the subareas tributary to the proposed sewer inlets. These inlets should be located at reversals of road grade from negative to positive and at street intersections. A maximum distance of 300 feet between catch basins will be allowed along long street grades.

C. Determine the acreage and imperviousness of each area.

D. Calculate the required capacity of each inlet using the appropriate time of concentration, the tributary area and the rational method.

E. Beginning at the highest elevation, compute the flow to be carried by each line. The time of concentration for each line other than the first in a series is the sum of the time of concentration to the inlet next upstream and the flow time in the connecting pipe. Where more than two lines meet, the time of concentration to be used for the succeeding line is the longest time in the lines meeting. Each line will thus require calculation of time of concentration, tributary area (all upstream areas), and flow.

F. Select tentative pipe sizes and grades using the Manning Formula. Each line must be selected in order since the time of concentration for subsequent lines will be dependent upon the time of flow in all upstream lines.

G. Minimum cover requirements specified by ASTM specifications must be met.

H. Figure 6.4, Computation for Storm Sewer Design, may be used for storm sewer calculation.

Figure 6.4 Pipe Flow Tabulation

COMPUTATION FOR STORM SEWER DESIGN																	
MANNING FORMULA: n _____ Project: _____ Date _____ Sheet No. _____																	
Manhole No.	**Begin/ End Sta.**	**Δ "A"**	**"C"**	**Δ "CA"**	**Sum "CA"**	**Δ "T"**	**Sum "T"**	**"I" ___YR**	**"I" ___YR**	**"Q" Disch ____ YR**	**"Q" Disch ____ YR**	**"L" FT.**	**Slope Ft./Ft.**	**Pipe Dia. In.**	**"V" FPS**	**CAP CFS**	**Flow Line Elev. Inlet/ Outlet**

600.05 Minimum Diameter

The minimum diameter of storm sewer pipe shall be 12 inches. The diameter shall be increased as necessary according to the design analysis.

600.06 Minimum Cover

The minimum cover over storm sewer pipe shall be 2 feet unless otherwise approved by the City Engineer. Cover is measured from the top of pipe to the finished grade directly above the pipe.

600.07 Minimum Slope

The minimum recommended slope for storm sewers shall be 0.10 feet per 100 feet, unless a greater slope is required to obtain the minimum mean velocity. Culverts may be installed on flatter grades as approved by the City Engineer.

600.08 Minimum Velocity

The absolute minimum mean velocity for all storm sewers shall be 2.0 feet per second when flowing full based on Manning's Formula using an "n" value of 0.013. Use of other "n" values will be considered if deemed justifiable on the basis of extensive field data. The desirable minimum velocity is 3.0 feet per second based on the same criteria.

600.09 Maximum Velocity

The maximum velocity of all storm sewers shall be 10 feet per second. If the velocity is greater than 10 feet per second, provisions should be made to protect against displacement and erosion of the pipe or as approved by the City Engineer.

600.10 Maximum Headwater

The maximum allowable headwater depth for culverts shall be 2 feet below pavement surfaces and/or finish floor elevations.

600.11 Manholes

Manholes or inlets shall be installed at the end of each line except at the discharge end; at all changes in grade, size, and alignment; and at all pipe intersections. Manholes shall be installed at distances not greater than 400 feet. Intervals of more than 400 feet may be approved in sewers 42 inches and larger. Manholes may be either poured-in-place or precast concrete. Concrete construction shall conform to ASTM C-478. Any changes of manhole or inlet placement shall be approved by the City Engineer.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

All manhole covers shall be adjusted to grade by the use of no more than 12 inches of precast adjusting collars.

Manholes shall be consistent with those shown in the standard drawings.

600.12 Manhole Minimum Diameter

Manholes shall be constructed large enough to allow access to all sewers. The minimum diameter of manholes shall be 48 inches. Where large sewers require the use of manholes with diameters greater than 48 inches, the manhole shall be returned to the 48-inch diameter as soon as practical above the sewer crown. Manhole openings of 24 inches or larger are recommended for easy access with safety equipment and to facilitate maintenance.

600.13 Catch Basins

Curb inlets shall be placed at all low points, points of change to a flatter street grade, the dead end of descending streets, and at the Point of Curvature and Point of Tangency of all intersection radius curves where the street grade descends toward the radius curve and at all intersections. The basis for the design and spacing of curb inlets shall conform to the Bureau of Roads Hydraulic Engineering Circular No. 12, "Drainage of Highway Pavements".

Under normal conditions, curb inlets shall be placed on both sides of the street at intervals indicated by the street grade. Approximate spacing ranges from 150 feet to 300 feet maximum with an average of 250 feet spacing under normal conditions for the spread of flow-in gutters.

Catch basins not placed in the street shall be selected and placed so that they blend with the surrounding and not appear unsightly.

Curb inlets shall be placed on the property lines if at all possible.

Driveway cuts shall not be placed at curb inlets.

Catch basin types shall be consistent with the types shown in the standard drawings.

600.14 Basis of Culvert Design

The basis of design for street and roadway culverts shall be the Ohio Department of Transportation's Location and Design Manual, Volume Two, Drainage Design.

Hydraulic analysis of culverts may also be performed utilizing Hydraulic Design Series No. 5, Hydraulic Design of Highway Culverts, Federal Highway Administration and Computer Program HY-8.

Design shall be based on a 25-year storm for full flow capacity and an overtopping capacity of at least a 100-year storm.

Culvert flow type must be determined for each culvert design. There are 2 types of culvert flow: Inlet Control and Outlet Control. This must be determined to help ensure proper culvert design.

Maximum allowable headwater shall be 1 foot below the low edge of the pavement. However, the designer should generally limit the maximum 100-year headwater depth to twice the diameter or rise of the culvert.

Tailwater conditions shall also be analyzed for all culverts. In some locations, a high tailwater will control the operation of the culvert. This condition can greatly effect the capacity and headwater of the culvert and shall be checked to help determine upstream design storm and storm water elevations.

600.15 Open Drainage Ditches

The basis of design for drainage ditches shall be the Manning Formula, as defined in Section 600.03. Table 6.2 may be used to determine the value of "n", Manning's Roughness Coefficient, to be used in the calculations. These calculations of open ditch capacity should be provided to the reviewing agency along with the construction drawings.

TABLE 6.3

CHANNEL MATERIAL	n
Vitrified clay	0.014
Cast iron pipe	0.015
Smooth earth	0.018
Firm gravel	0.023
Corrugated metal pipe	0.022
Natural channels in good condition	0.025
Natural channels with stones and weeds	0.035
Very poor natural channels	0.060

600.16 Channel Protection

Channel protection material shall be placed at pipe outlets and other areas of high velocity flow to prevent erosion. The type, location and depth of the protective material shall be reviewed and approved by the City.

600.17 Storm Water Detention Basin/Retention Pond Size Requirements

It is recognized that certain outlets for storm water runoff in the City may be very limited. These outlets do not have the capacity to receive and convey the increased runoff resulting from rapid development around the City.

Developer/Owners must participate in providing detention storage to eliminate the excessive runoff during heavy storm periods. Where impervious areas are planned or contemplated, it is the intent that detention be provided as required by the provisions hereinafter set forth. It is proposed that well maintained landscaped areas would be provided to act jointly as detention reservoirs and recreation facilities as aesthetic focal points in new developments. Other control methods to regulate the rate of storm water discharge which may be acceptable, include detention on parking lots, streets, lawns, underground storage, oversized storm sewers with restricted outlets, etc. However, these methods must be approved by City officials.

It is recognized that in order to better serve the long-range interests of the City and the surrounding area, comprehensive basin-wide planning for runoff control should be formulated, adopted, and implemented. Comprehensive planning is far more beneficial than

small, on-site detention areas, although on-site detention does provide protection and is acceptable for compliance.

Normal detention of storm water shall be required for all developments and proposed development which would alter storm runoff as to flow, velocity, or time of concentration. These basins are required to detain the peak post-developed runoff which exceeds the runoff created by a 5-year storm under predeveloped condition. The City reserves the option to require more stringent detention requirements based upon the estimated capacity of the existing storm sewers. All calculations must be submitted to the City for approval. Calculations must include a profile of the existing storm sewer from the proposed connection point to a point 500 feet downstream or the first outfall structure nearest to or beyond the required 500 feet. The calculated full flow capacity of the existing storm water outfall shall also be provided.

Design of storm water detention facilities shall be based on the following:

A. The City suggests that runoffs and capacities are to be computed using the Rational Method and Manning Formula as determined in Section 600.03 of this document for areas less than 20 acres.

B. The release rate from on-site detention shall not be greater than the storm runoff created by the pre-developed site during a 5-year frequency storm. The allowable outflow rate used in Figure 6.5 “Storage Calculation for Drainage Basin” is derived using a C coefficient of 0.2 and a rainfall intensity of 3.65 inches based on 5 years with a duration of 15 minutes multiplied by the site area. Consideration may be given for different intensity and coefficient based on the situation. If runoff from off-site acreage flows through the detention basin, storage volume should be calculated using Figure 6.5 for the on-site area only. After the volume has been calculated, the allowable outflow rate should be calculated using the acreage of the entire area draining across the site.

C. Storage volume shall not be less than the storm runoff created by the post-developed site during a 100-year storm event. The storage volume may be computed by using the appropriate Figure 6.5, “Computation Worksheet for Detention Storage Using Rational Method” based on imperviousness.

Table 6.4 "Percentage of Impervious Area" is used to calculate detention required for each land use.

Table 6.4 Percentage of Impervious Area

10%	N-1 Non-Urban Residence
20%	S-2 Suburban Residence
30%	R-1 Single-Family Residence
30%	R-2 Single and Two-Family Residence
40%	R-3 Multi-Family Residence
90%	B-1 Local Business
90%	B-2 Community Business
90%	B-4 General Business/Light Industrial
90%	B-5 Court Square Business
70%	I-2 Heavy Industrial
90%	O-1 Office

D. Outlet size shall be determined by using the orifice equation as defined by:

$$Q = CA\sqrt{2gH}$$

C = 0.6
A = Area in square feet
g = 32.2 ft./s^2
H = height from the center of the pipe to the top of the water surface

E. Special detention consideration may be given by the City Engineer for high impervious areas that are smaller than two acres in size.

An emergency overflow from the basin to a major storm system must be provided to protect the facility and adjacent properties. The designer should investigate the capacity of the downstream drainage facilities to determine if they will be adequate to handle the design flow from this particular development. If the downstream facilities are inadequate, it may be necessary to provide on-site retention or ponding basins to limit the flow to an amount which the downstream system can accept.

CITY OF SIDNEY

DEPARTMENT OF ENGINEERING
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Date: _____

STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5a

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 10% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.14	9.9						
8 MIN 0.133	0.18	8.2						
10 MIN 0.167	0.20	7.6						
15 MIN 0.250	0.24	6.3						
20 MIN 0.333	0.28	5.5						
30 MIN 0.500	0.33	4.4						
40 MIN 0.667	0.37	3.3						
60 MIN 1.000	0.42	2.8						
100 MIN 1.667	0.48	1.9						
200 MIN 3.333	0.58	1.1						

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STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5b

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 20% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.18	9.9						
8 MIN 0.133	0.22	8.2						
10 MIN 0.167	0.24	7.6						
15 MIN 0.250	0.28	6.3						
20 MIN 0.333	0.32	5.5						
30 MIN 0.500	0.38	4.4						
40 MIN 0.667	0.41	3.3						
60 MIN 1.000	0.46	2.8						
100 MIN 1.667	0.53	1.9						
200 MIN 3.333	0.62	1.1						

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STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5c

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 30% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.22	9.9						
8 MIN 0.133	0.25	8.2						
10 MIN 0.167	0.28	7.6						
15 MIN 0.250	0.32	6.3						
20 MIN 0.333	0.36	5.5						
30 MIN 0.500	0.42	4.4						
40 MIN 0.667	0.46	3.3						
60 MIN 1.000	0.51	2.8						
100 MIN 1.667	0.57	1.9						
200 MIN 3.333	0.66	1.1						

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STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5d

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 40% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.25	9.9						
8 MIN 0.133	0.29	8.2						
10 MIN 0.167	0.32	7.6						
15 MIN 0.250	0.36	6.3						
20 MIN 0.333	0.41	5.5						
30 MIN 0.500	0.46	4.4						
40 MIN 0.667	0.50	3.3						
60 MIN 1.000	0.55	2.8						
100 MIN 1.667	0.61	1.9						
200 MIN 3.333	0.71	1.1						

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STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5e

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 70% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.37	9.9						
8 MIN 0.133	0.42	8.2						
10 MIN 0.167	0.44	7.6						
15 MIN 0.250	0.49	6.3						
20 MIN 0.333	0.53	5.5						
30 MIN 0.500	0.59	4.4						
40 MIN 0.667	0.63	3.3						
60 MIN 1.000	0.68	2.8						
100 MIN 1.667	0.74	1.9						
200 MIN 3.333	0.80	1.1						

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STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5f

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 90% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.45	9.9						
8 MIN 0.133	0.49	8.2						
10 MIN 0.167	0.51	7.6						
15 MIN 0.250	0.57	6.3						
20 MIN 0.333	0.61	5.5						
30 MIN 0.500	0.67	4.4						
40 MIN 0.667	0.71	3.3						
60 MIN 1.000	0.77	2.8						
100 MIN 1.667	0.83	1.9						
200 MIN 3.333	0.87	1.1						

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STORAGE CALCULATIONS FOR DRAINAGE BASIN

Figure 6.5g

STORM DURATION T MIN/HOUR	RUNOFF COEF. C 100% IMP.	RAINFALL INTENSITY i (IN/HR) 100 YEAR	AREA (ACRES) A	INFLOW DEVELOPED Qi = CiA 100 YR - CFS	OUTFLOW NATURAL Qo = 5YR-60M .2(3.65)A	STORAGE RATE Qi-Qo (CFS)	STORAGE REQUIRED 1/12 (Qi-Qo)T (ACRE-FEET)	REMARKS
5 MIN 0.083	0.49	9.9						
8 MIN 0.133	0.52	8.2						
10 MIN 0.167	0.55	7.6						
15 MIN 0.250	0.61	6.3						
20 MIN 0.333	0.65	5.5						
30 MIN 0.500	0.71	4.4						
40 MIN 0.667	0.75	3.3						
60 MIN 1.000	0.81	2.8						
100 MIN 1.667	0.86	1.9						

600.18 Detention Basin/Retention Pond Guidelines

A. RECOMMENDATIONS FOR DRY DETENTION BASINS

1. Where water quality during dry weather periods in a small basin would be a potential problem due to lack of adequate dry weather flow, direct pollution from surface water runoff, or high nutrients in the flow; the basin should be designed to remain dry except when in flood use.

2. Dry detention basins shall be designed to minimize the wetness of the bottom so that water does not remain standing in the bottom; thereby harboring insects and limiting the potential use of the basin. This shall be accomplished by means of a concrete low flow channel between inlet and outlet structures. Minimum slope shall be no less than 0.5%. An acceptable alternative to a concrete low flow channel will be an underdrain. In this case, a minimum of 1% slope shall exist between inlet and outlet structures and the surface above the underdrain shall be grass sod.

3. The detention basin should be designed to have a multi-purpose function. Recreational facilities, aesthetic qualities, etc., as well as flood water storage should be considered in planning the basin.

4. Side slopes shall be 3:1 or flatter.

5. There shall be a minimum of a 3-foot berm at 2% between right-of-way and top basin slopes.

B. RECOMMENDATIONS FOR BASINS CONTAINING PERMANENT WATER

1. In order to provide better management for water quality, retention basins containing permanent lakes should have a water area of at least one-half acre. The lake area should be an average depth of 5 feet to inhibit weed and insect growth, and should have no extension shallow areas. A system to augment storm flows into the lake with water from other sources should be provide to enhance the water quality, if necessary. These systems would include the use of public water supplies or wells on site.

2. In excavated lakes, the underwater side slopes in the lake should be stable.

3. A safety ledge 4 feet to 6 feet in width is recommended and should be installed in all lakes approximately 18 inches to 24 inches below the permanent water level to provide a footing if people fall into the water. In addition, there shall be a minimum of a 5 berm at 2% slope beginning at least 1 foot above normal pond elevation. The slope between 2 ledges should be stable and of a material

which will prevent erosion due to wave action (see Figure 6.6). Walkways consisting of a non-erosive material should be provided in areas where extensive population use tramples growth. One area in particular would be along the shoreline of a heavily fished lake. Side slopes above the berm shall be 3:1 or flatter.

4. Side slopes of the pool shall be 2:1 or flatter.

5. To obtain additional recreational benefits from developed water areas and provide for insect control, ponds may be stocked with fish. For best results, stocking should follow recommendations for warm water sport fishing by the Ohio Department of Conservation, Division of Fisheries, or similar organizations.

6. Periodic maintenance will be required in lakes to control weed and larval growth. The basin should also be designed to provide for the easy removal of sediment which will accumulate in the lake during periods of basin operation. A means of maintaining the designed water level of the lake during prolonged periods of dry weather is also recommended. One suggested method is to have a water hydrant near the pond site.

7. No rubble or construction refuse shall be disposed of at any time.

8. No pond with a permanent water elevation shall be placed within 1 mile of a runway approach or landing approach to an airport.

C. RECOMMENDATIONS COMMON TO EITHER DRY DETENTION BASINS OR RETENTION BASINS WITH PERMANENT WATER

1. A 20-foot-wide City easement shall be provided for access to all storm water storage ponds. The top of berm centerline plus a 15-foot buffer/access area will be included in the storm sewer petition.

2. All basins shall have an emergency overflow.

3. All excavated spoils should be spread so as to provide for aesthetic and recreational features such as sledding hills, sports fields, etc. Slopes of 6 horizontal to 1 vertical are recommended except where recreation uses call for steeper slopes. Even these features should have a slope no greater than 3 horizontal to 12 vertical for safety, minimal erosion, stability, and ease of maintenance.

4. When conduits are used for the outlet of the reservoir, they shall be protected by bar screens or other suitable provisions so that debris or similar trash will not interfere with the operation of the basin.

5. Safety screens should also be provided for any pipe or opening to prevent children or large animals from crawling into the structures. For safety, a suggested maximum opening is 6 inches.

6. Grass or other suitable vegetative cover should be maintained throughout the entire reservoir area. Grass should be cut regularly no less than five times a year.

7. Debris and trash removal and other necessary maintenance should be performed after each storm to assure continued operation in conformance to the design.

D. INSPECTION OF BASINS

1. Record drawings will be required for all basins to assure compliance with all applicable requirements.

2. The City may inspect all private detention basins and if problems exist, report these to the owner. The owner shall be given a reasonable amount of time to correct the problem, weather permitting, as per City Ordinance A-1947.

3. The City shall perform such work as it deems necessary and charge owner if the owner fails to correct the problem.

E. DETENTION BASIN OWNERSHIP

1. Detention basin maintenance and ownership shall remain private.

2. Owners will be responsible for routine maintenance of the development detention basin located on their lots. Grass mowing, ornamental landscaping, and fencing are considered routine maintenance. No activity which will interrupt the operation of the detention basin will be allowed. No accessory buildings or gardens will be permitted. The City will be responsible for major erosion control and fixed structures such as piping, manholes, and inlets, if covered under petition. This statement shall be added to each deed of transfer.

F. SUBMERGED OUTLETS

Submerged outlets may be permitted provided a manhole is constructed between the outlet at the retention pond and the main storm system. This manhole must also be after the last pavement crossing. The invert elevation of the pipe into this manhole will be at least 1 foot above the normal pool elevation. The slope of the basin at the outlet shall be no flatter than 2:1 to avoid siltation at the outlet. The

manhole shall have a grated casting or, in some cases, may require being a manhole with a catch basin with windows frame and top.

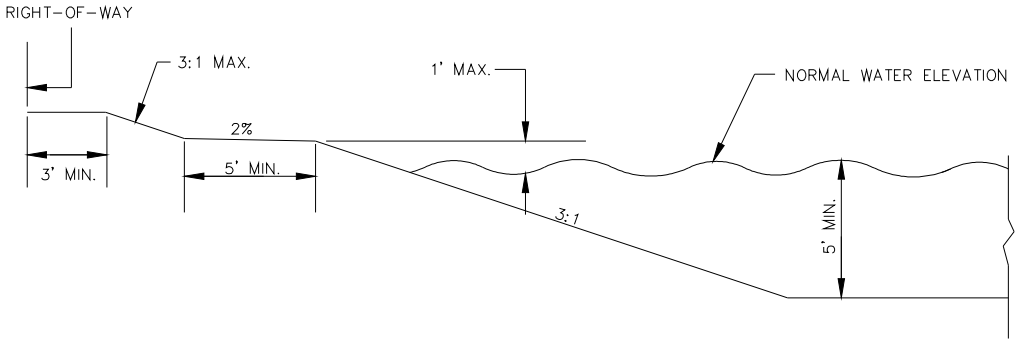
G. OUTLET MATERIAL

Outlet structure materials shall be reinforced concrete and/or RCP pipe. Stainless steel plates shall be used if orifice size is smaller than available RCP sizes.

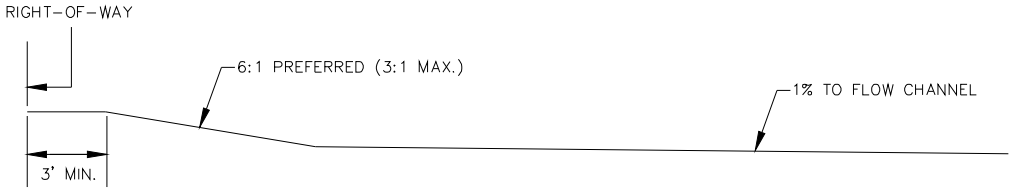
Figure 6.6

SLOPE DESIGN FOR STORM WATER STORAGE FACILITIES

RETENTION POND



DETENTION BASIN OR DRY BASIN



LOW FLOW CHANNEL–PAVED 0.5% GRADE MINIMUM TO 1% GRADE, REQUIRED

ALTERNATE–UNDERDRAINS WITH SOD IN LOW FLOW CHANNEL 1% GRADE OR GREATER

AS–BUILTS ARE REQUIRED.

600.19 Flood Routing Path

A. CAPACITY

The flood routing path is that part of the major storm drainage system that carries the runoff that exceeds the capacity of the designed drainage facilities. The major storm drainage system shall have the capacity to carry runoff from a storm with a return period of not less than 100 years without causing significant threat to property or public safety.

B. SURFACE FLOOD ROUTING PATHS

Generally, it is not economically feasible to size a storm sewer system to collect and convey more than the frequent storm runoff. Essentially, the complete drainage system of an urban area contains two separate drainage elements. While the storm sewers belong to the initial system, surface drainage ways must be provided for the major flow from more intense storms.

C. INTENT IN PROVIDING FLOOD ROUTING PATHS

The intent of planning for the major drainage element is to ensure storm water runoff which exceeds the capacity of the initial drainage system has a route to follow which will not cause a major loss of property or any loss of life. It should be remembered that the major drainage system exists even when it is not planned for and whether or not development exists in respect to it.

D. STREET RIGHTS-OF-WAY

Street rights-of-way are common choice for conveying major drainage flows. Such use must be anticipated when the street layout is established. Side and rear lot lines offer one alternative to the street. The problem with this alternative is the possibility of individual property owners encroaching on the major drainage easement. Rarely is the problem recognized until the frequent rainstorm occurs and the major system fails to operate properly.

Where the street is designated as the major drainage way, the depth of flow shall not exceed 12 inches at the gutter line for local and collector streets and the crown for arterial streets. The same maximum depth criteria will apply where a major drainage way crosses the street. Where a major drainage way is located outside a street right-of-way, easements shall be provided. All major storm routing easements shall be shown on the grading plan.

E. MULTI-PURPOSE FLOOD ROUTING PATHS

In order to protect the integrity of the non-street drainage rights-of-way, the consultant is encouraged to design flood routing paths for multi-purpose functions. Pedestrian and bicycle paths lend themselves naturally to this application. Linear parks aligned along the major drainage corridor are also very effective, but usually require greater width than would normally be necessary for drainage purposes.

F. MAJOR STORM RUNOFF

The major storm runoff is routed through the drainage system to determine if the combined capacity of the flood routing path and storm sewer system is sufficient.

600.20 Site Grading

A. SITE GRADING PLAN

Site grading plans shall be prepared with 1 foot existing and proposed contours showing all lots or lots having proper drainage. Site grading plans for developments shall also have proposed building pad elevations to ensure proper drainage of the development. Individual site plans within a development must conform to the subdivision drainage site plan.

B. CUTS AND FILLS

No land shall be graded, cut, or filled so as to create a slope exceeding a vertical rise of 1 foot for each 2½ feet of horizontal distance between abutting lots, unless a retaining wall of sufficient height and thickness is provided to retain the graded bank. Major cuts, excavation, grading, and filling, where the same material changes the site and its relationship with surrounding areas, shall not be permitted as such excavation, grading, and filling will result in a slope exceeding a vertical rise of 1 foot for each 2½ feet of horizontal distance between abutting lots or between adjoining tracts of land, except where adequate provision is made to prevent slides and erosion by cribbing and retain walls.

C. COMPACTION OF FILL

All fill shall be compacted to a density of 95% or greater. Inspection of fill shall be conducted by the City Engineer.

D. RETAINING WALLS

Retaining walls may be required whenever topographic conditions warrant or where necessary to retain fill or cut slopes within the right-of-way. Such improvements shall require the approval of the City Engineer.

E. FILLING OF EXISTING AREAS

No existing area shall be filled or graded to adversely affect adjoining properties, as determined by the City Engineer.

600.21 Runoff from Upstream Drainage Areas

The runoff from drainage areas upstream of the proposed development or improvement must be provided with an unobstructed outlet and an emergency overflow. The system should provide the capacity needed to carry the runoff from a 5-year storm in its existing land use condition.

600.22 Runoff from Contiguous Properties

All site drainage shall be contained on-site. No land altering activity shall disperse runoff into areas adjacent to the area experiencing development.

600.23 Soil Sediment Pollution Control Regulations

A. The purpose of the regulation is to prevent the undue polluting of public waters by sediment from accelerated soil erosion and accelerated storm water runoff caused by earth-disturbing urban areas. Control of such pollution will promote and maintain the health, safety, and general well-being of all life and inhabitants herein the City.

B. SCOPE

This shall apply to earth-disturbing activities on areas of land used or being developed for commercial, industrial, residential, recreational, public service, or other non-farm purposes which are within the City unless otherwise excluded within or unless expressly excluded by state law.

C. DISCLAIMER OF LIABILITY

Neither submission of a plan under provisions of this article nor compliance with provisions of these regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law, nor imposed any liability upon the City or its appointed representative for damage to any person or property.

D. SEVERABILITY

If any clause, section, or provision of this resolution is declared invalid or unconstitutional by a court of competent jurisdiction, validity of the remainder shall not be affected thereby.

E. REQUIREMENTS

No person shall cause or allow earth-disturbing activities on a development area except in compliance with the standards and criteria and the applicable item listed below:

1. When a proposed development area consists of five or more acres and earth-disturbing activities are proposed for the whole area or any part thereof, the responsible person shall develop and submit for approval a sediment control plan prior to any earth-disturbing activity. Such a plan must contain sediment pollution control practices so that compliance with other provisions of this resolution will be achieved during and after development. Such a plan shall include specific requirements established by regulation.

2. When a proposed development area involves less than five acres, it is necessary to submit a sediment control plan. All earth-disturbing activities shall be subject to surveillance and site investigation to determine compliance with the standards and regulations.

3. Erosion Control Plan General Notes must be included and consist of the following:

    a. Preconstruction Notes

    Grading operations shall not begin until the City approves erosion control. Contractor is responsible to install and maintain tire scrubbers at each construction site access, and to clean up mud and debris tracked onto the roadway within 24 hours or sooner.

    b. During Construction Maintenance Notes

    The Contractor must maintain erosion control measures until area is stabilized.

    c. Post Construction Note

    Contractor shall seed and mulch the entire site within 30 days of final grading.

F. STANDARDS AND CRITERIA

In order to control sediment pollution of water resources, the owner or person responsible for the development area shall use conservation planning and practices to maintain the level of conservation established by one or more of the following standards:

1. Timing of Sediment-Trapping Practices - Sediment control practices shall be functional throughout earth-disturbing activity. Settling facilities, perimeter controls, and other practices intended to trap sediment shall be implemented as the first step of grading and within 7 days from the start of earth disturbing activities. They shall continue to function until the upslope developed area is restabilized.

2. Stabilization of Denuded Areas - Denuded areas shall have soil stabilization applied within 7 days if they are to remain dormant for more than 30 days. Permanent or temporary soil stabilization shall be applied to denuded areas within 7 days after final grade is reached on any portion of the site, and shall also be applied within 7 days to denuded areas which may not be final grade, but will remain dormant (undisturbed) for longer than 30 days.

3. Settling Facilities - Concentrated storm water runoff from denuded areas shall pass through a sediment-settling facility. The facility's storage capacity shall be 67 cubic yards per acre of drainage area.

4. Sediment Barriers - Sheet flow runoff from denuded areas shall be filtered. Sediment barriers such as sediment fence or straw bales shall protect adjacent properties and water resources from sediment transported by sheet flow.
5. Storm Sewer Inlet Protection - All storm sewer inlets which accept water runoff from the development shall be protected so that sediment-laden water from soils that are not permanently stabilized will not enter the storm sewer system without first being filtered or otherwise treated to remove sediment.

6. Working in Crossing Streams

    a. Streams including bed and banks shall be restabilized immediately after in-channel work is completed, interrupted, or stopped. To the extent practicable, construction vehicles shall be kept out of streams. Where in-channel work is necessary, precautions shall be taken to stabilize the work area during construction to minimize erosion.
    b. If a live (wet) stream must be crossed by construction vehicles regularly during construction, a temporary stream crossing shall be provided.

7. Construction Access Routes - Measures shall be taken to prevent soil transport onto surfaces where runoff is not checked by sediment controls or onto public roads.

8. Sloughing and Dumping

    a. No soil, rock, debris, or any other material shall be dumped or placed into a water resource or into such proximity that it may readily slough, slip, or erode into a water resource unless such dumping or placing is authorized by the approving agency and, when applicable, the U.S. Army Corps of Engineers, for such purposes, including but not limited to, constructing bridges, culverts, and erosion control structures.
    b. Unstable soils prone to slipping or land sliding shall not be graded, excavated, filled, or have loads imposed upon them unless the work is done in accordance with a qualified professional engineer's recommendations to correct, eliminate, or adequately address the problems.

9. Cut and Fill Slopes - Cut and fill slopes shall be designed and constructed in a manner which will minimize erosion. Consideration shall be given to the length and steepness of the slope, soil type, upslope drainage area, groundwater conditions, and slope stabilization.

10. Stabilization of Outfalls and Channels - Outfalls and constructed or modified channels shall be designed and constructed to withstand the expected velocity of flow from a post-development, 10-year frequency storm.
11. Establishment of Permanent Vegetation - A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized.

12. Disposition of Temporary Practices - All temporary erosion and sediment control practices shall be disposed of within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed, unless otherwise authorized by the approving agency. Trapped sediment shall be permanently stabilized to prevent further erosion.

13. Maintenance - All temporary and permanent erosion and sediment control practices shall be designed and constructed to minimize maintenance requirements. They shall be maintained and repaired as needed to assure continued performance of their intended function. The person or entity responsible for the continued maintenance of permanent erosion controls shall be identified to the satisfaction of the approving agency.

The standards are general guidelines and shall not limit the right of the approving agency to impose additional, more stringent requirements, nor shall the standards limit the right of the approving agency to waive individual requirements.

Erosion and sediment control practices used to satisfy the standards shall meet the specifications in the current edition of water management and sediment control for urbanizing areas (Soil Conservation Service, Ohio).

G. MAINTENANCE

The property owner shall assume responsibility for maintenance of structures and other facilities designed to control erosion.

600.24 Drainage Easement Criteria

A. An adequate easement shall be required along any subsurface drainage tile, detention basin, drainage way, ditch, watercourse, stream, or storm sewer that is not already within the street right-of-way. The easement shall be of sufficient width to allow cleaning, widening, deepening, and replacing or otherwise general maintaining of such drainage course.

Easements for flood routes (100-year) shall be established to 1 foot above the 100-year storm elevation.

B. When it is required to convey subsurface drainage or surface water outside the limits of the proposed improved area in order to discharge into an approved adequate outlet, it shall be the responsibility of the Developer to obtain easements or rights-of way for construction and maintenance of said drainage course.

C. All drainage easements shall be shown on the final plat and the "Final Engineering and Construction Plan". The drainage easements shall be recorded for public use, and the maintenance of such drainage courses shall be the responsibility of the property owners receiving direct benefit therefrom, unless otherwise provided. Drainage easement widths shall conform to the City Engineer's supplement to these Standards.

D. Where no direct access is provided to a drainage feature, an adequate access easement shall also be provided. The minimum width of any such easement shall be 15 feet.

Minimum Permanent Easement Width for all Storm Sewers

Depth (Feet)	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset	Total Min. Width	* Min. Dist. C.L. Offset
	12-inch		**15-inch**		**18-inch**		**21-inch**	
2	25	10	--	--	--	--	--	--
3	30	11	30	12	30	12	30	12
4	30	12	30	12	30	12	30	12
5	30	12	30	12	30	12	30	12
6	30	12	40	12	40	12	40	12
7	40	12	40	12	40	12	40	12
8	40	12	40	12	40	12	40	12
9	40	12	40	12	40	12	40	12
10	40	12	40	13	45	13	45	13
	24-inch		**27-inch**		**30-inch**		**36-inch**	
3	30	12	--	--	--	--	--	--
4	30	12	30	12	30	12	30	13
5	30	12	30	12	30	12	40	13
6	40	12	40	12	40	12	40	13
7	40	12	40	13	40	13	40	13
8	40	13	40	13	40	13	40	13
9	40	13	45	13	45	13	45	13
10	45	13	45	13	45	13	45	13
11	45	13	45	13	45	13	45	13
	42-inch		**48-inch**		**54-inch**		**60-inch**	
5	35	13	35	13	--	--	--	--
6	35	13	35	13	35	14	35	14
7	35	13	35	13	35	14	35	14
8	45	13	45	14	45	14	45	14
9	45	14	45	14	45	14	45	14
10	45	14	45	14	45	14	45	14
11	45	14	45	14	55	14	55	15
12	55	14	55	14	55	14	55	15

*Minimum distance from centerline of pipe to either side of easement.
Table values are in feet unless otherwise noted.

800.00 WATER DISTRIBUTION

800.01 General

The following Design criteria are summarized herein to establish practical, uniform design of water distribution systems for the City. These criteria cover design factors and provide guidelines for evaluation of plans and specifications by the City departments having jurisdiction over the review of plans and specifications. These design criteria are also intended to conform to the standard drawings for water systems. All improvements to the water distribution system shall be coordinated with the City Engineer's Office and the Superintendent of the Water Treatment Plant.

800.02 Basis of Design

The basis of design for water distribution systems shall be the Hazen-Williams Equation, an empirical formula for estimating pipe flow:

$$V = 1.318CR^{0.63}S^{0.54}$$

V = Velocity in feet per second
C = Roughness Coefficient
R = Hydraulic Radius (pipe diameter in feet for pipes flowing full) in feet
S = Head loss per unit length of pipe

Distribution systems shall be designed for the estimated maximum day rate of flow, or the fire flow plus the estimated average day rate of flow, whichever is more demanding. Selection of a roughness coefficient shall be coordinated through the City Engineer.

800.03 Minimum Pressure

The minimum desirable pressure in the water distribution system, at times of no fires, shall be 50 pounds per square inch in all mains, and 8 pounds per square inch at the most remote house fixture in the system. The minimum fire flow for design purposes shall be 600 gallons per minute at a residual pressure of 20 pounds per square inch.

800.04 Maximum Velocity

The maximum velocity of the water in the system shall be 10 feet per second.

800.05 Water Mains

The value of C to be used in the Hazen-Williams Equation shall be C=130. The minimum size of water mains shall be 6 inches in diameter. Dead-ending mains shall be minimized by looping of all mains. In the event the City permits a dead-end, they should be provided with a fire hydrant for flushing purposes.

The minimum depth of water mains shall be 4 feet, 6 inches from the top of the pipe to the finished grade elevation. The maximum depth of water mains shall be 6 feet from the top of the main to the finished grade elevation, except where utilities must be underpassed or as directed by the City.

800.06 Water Service Lines

The value of C to be used in the Hazen-Williams Equation shall be C = 130. The minimum diameter of service lines shall be ¾ inches, unless the distance from the main to the meter exceeds 120 feet, where the minimum service line diameter shall be 1 inch. Table 8.1 lists required minimum service sizes as determined by residential population. Fire hydrant services shall have a minimum diameter of 6 inches, but shall be no larger than the water main. For all ¾-inch through 2-inch services, a corporation stop shall be installed on the main at a 45° angle above horizontal. For services larger than 2 inches, a tapping sleeve and valve must be installed.

TABLE 8.1

MINIMUM SIZE -- WATER SERVICES AND METERS
RESIDENTIAL AREAS

No. of Families	Service Size (inches)	Meter Size (inches)
1	3/4	5/8 x 3/4
2-5	1	1
6-8	1-1/2	1 1/2
9-12	2	1 1/2
13-20	2	2
21-50	4	3
51-115	4	4

800.07 Meter Installation

When not completed by the City Water Department, meter installation for individual services shall be consistent with the standard drawings. Table 8.2 lists required meter sizes as determined by Maximum Flow Demand for Commercial-Industrial Applications. Meters must be installed prior to connecting the service to the main and before service starts. No common meters will be approved. All plans shall indicate meter and service stop location with a note stating "Location shall be coordinated with City Water or Engineering Staff".

TABLE 8.2

METER SIZE FOR COMMERCIAL-INDUSTRIAL APPLICATIONS

Maximum Flow Demand (GPM)	Meter Size (inches)
20	5/8 x 3/4
30	3/4
50	1
100	1 1/2
160	2
320	3
500	4
1000	6

800.08 Backflow Prevention

All commercial, industrial and other OEPA required users shall provide adequate backflow prevention between the public water system and the customer's system. These devices shall be approved by the OEPA and the City of Sidney prior to construction and installation. These devices shall be tested and inspected annually under the supervision of the Water Superintendent or his designee and paid for by the owner of the property. These devices shall be repaired or replaced if they do not meet the testing requirements. An annual report shall be submitted by a licensed plumber in the State of Ohio to the City of Sidney detailing the testing procedures and results.

900.00 SANITARY SEWERS

900.01 General

The following Design Criteria are summarized herein to establish practical, uniform design of sanitary sewers within the City of Sidney, Ohio. These criteria cover design factors and approved guidelines for evaluation of plans and specifications by the City departments having jurisdiction over the review of plans and specifications. These design factors are consistent with the requirements of the OEPA. If these design criteria should conflict in the future with the requirements of the OEPA, these criteria shall be modified to conform to their requirements. These design criteria are also intended to conform to the standard drawings for sanitary sewers.

900.02 Minimum Velocity

All sanitary sewers shall be designed to give a mean velocity of at least 2.0 feet per second, when flowing full, based on Manning's Formula using an "n" value of 0.013. Use of other "n" values will be considered, if deemed justifiable, on the basis of extensive field data.

900.03 Maximum Velocity

The maximum velocity shall be 15 feet per second. If the velocity is greater than 15 feet per second, provisions should be made to protect against displacement. The provisions will be concrete collars, anchoring, and ductile iron pipe.

900.04 Minimum Grades

All sanitary sewers shall be designed to give a mean velocity of at least 2.0 feet per second when flowing full based on Manning's Formula. Values of "n" to be used with the Manning Formula vary from 0.010 to 0.015 with 0.013 recommended. Use of "n" values other than 0.013 may be considered if justified. Use of formulas other than Manning's Formula may be accepted. If plans are recommended for approval with a slope less than the minimum, the consulting Engineer must show justification for the recommendation and obtain approval from OEPA. See Table 9.1.

TABLE 9.1

REQUIRED MINIMUM SLOPE

Based on "n" Value of 0.013
Sewer Sizes - 8 through 36 inches

Sewer Size	Minimum Slope in Feet Per 100 Feet
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

900.05 Sanitary Sewers

In general, the minimum size of sanitary sewers shall be 8 inches. Six inches will not be considered as a main line sewer; however, 6-inch sanitary sewers may be used as private lateral sewers for apartments, camps, schools, restaurants, and other semi-public operations, provided their hydraulic capacity is not exceeded because of short run-off periods (high peak flows). In multi-tenant buildings, individual services shall be provided to a common pipe, then to the main.

The lateral connections shall be premium joint construction and should be made of the same material as the street sewer whenever possible to minimize infiltration from the connection between the street main and house lateral. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided.

900.06 House Laterals

Four-inch sewer pipe may be used for house connections. The cover over the lateral coming out of the house shall be a minimum depth of 3 feet. The house connections shall be of premium joint construction and made of PVC schedule 40 pipe or SDR-35. Cleanouts for laterals longer than 100 feet are required outside all structures or units. Individual meters shall be used for separate sanitary sewers. When joint material and/or dimensions are not compatible, a commercial adapter shall be provided. A copy of an ordinance or regulation requiring this type of construction must be on file with OEPA district office or submitted with all sewer plans to receive approval.

900.07 Invert Drop in Manhole

When a smaller sewer discharges into a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing this result is to place the 0.8 depth point of both sewers at the same elevation or matching the top elevation of the pipes. When a larger sewer discharges into a smaller, the invert of the smaller should not be raised to maintain the same energy gradient.

900.08 Illegal Connections

Roof drains, foundation drains, sump pumps, yard drains, and all other clear water connections to the sanitary sewer are prohibited.

There shall be no physical connection between a public or private potable water supply system and a sewer or appurtenances thereto which would permit the passage of any sewage or polluted water into the potable supply.

900.09 Utility Separations

Sanitary sewers and sewage forcemains should be laid with at least a 10-foot horizontal and 18-inch vertical separation from any water main. This is enforceable for both main line and laterals. If a repair occurs with both water and sanitary in the same trench, the City will allow the utilities to remain in the same trench.

If it is impossible to maintain the 18-inch vertical separation when the sewer is laid closer than 10 feet to the water main, the sanitary sewer should be constructed of (or encased in) water main type materials (ductile iron is preferred) which will withstand a 50 psi water pressure test.

If a sewage forcemain is laid closer than 10 feet to a water main, in no case should the sewage forcemain be laid such that the crown of the sewage forcemain is less than 18 inches below the water main.

Sewers (or sewage forcemain) may be laid closer than 10 feet to a water main if it is laid in a separate trench and elevation of the crown of the sewer (or sewer forcemain) is at least 18 inches below the bottom of the water main

900.10 Crossing Utilities

Whenever a sanitary sewer and water main must cross, the sewer shall be laid at such an elevation that the crown of the sewer is at least 18 inches below the bottom of the water main. If it is absolutely impossible to maintain the 18-inch vertical separation, the sanitary sewer should be constructed of water main type material which will

withstand a 50 psi water pressure test for a distance of 10 feet on both sides of the water main.

Whenever a sewage forcemain and water main must cross, the sewage forcemain is at least 18 inches below the bottom of the water main.

900.11 Manholes

Manholes shall be installed at the end of each line, at all changes in grade, size, alignment, and at all pipe intersections. Manholes shall be installed at a distance not greater than 400 feet for 8-inch to 15-inch and 350 feet for 15-inch or greater. Greater spacing may be allowed in larger sewers and in those carrying a settled effluent. Water-tight castings are to be non-vented. Vented manholes will be determined by the Utility Supervisor.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

All manhole covers shall be adjusted to grade by the use of no more than 12 inches of precast concrete adjusting collars. Metal adjustment rings will not be allowed. In areas outside the pavement, the manhole casting should be adjusted so that the top is slightly above grade to prevent the entrance of the surface water off pavement

900.12 Manhole Minimum Diameter

Manholes shall be constructed large enough to allow access to the sewer. The minimum diameter of manholes shall be 48 . Where manhole diameters of greater than 48 inches are used to accommodate the sewer pipes, the manhole shall be returned to a 48-inch diameter as soon as practical above the sewer crown. Manhole openings 24 inches or larger are recommended for easier access with safety equipment to facilitate maintenance.

900.13 Manhole Water Tightness

Manholes shall be constructed to permit casting adjustments by use of cast-in-place or precast concrete adjusting collars not to exceed 12 inches in height. Solid manhole covers shall be used in all pavement locations. In other areas, the manhole casting shall be adjusted so the top of the manhole cover is slightly above grade to prevent the entrance of the surface water. In areas subject to flooding, secured watertight and solid manhole covers should be used. All manhole covers, seating frames, and adapter rings shall be machined to a firm and even bearing to provide a true fit into the frames. Manholes shall be installed with chimney seals and water tight dishes.

Inlet and outlet pipes should be joined to the manhole with a gasketed and/or flexible watertight connection meeting ASTM Specification C-443. Where three or more

manholes in sequence are to be constructed with solid, watertight covers, adequate ventilation shall be provided.

900.14 Flow Channel

The invert of the lowest pipe entering manhole shall be at least 3 inches (75 mm) above the top of the base slab so that the sewer flow channel maybe installed and shaped. The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers.

Cut pipe shall not extend beyond the inside face of the manhole wall. Concrete placed inside the manhole to form the channel through the manhole shall not be placed between the pipe and the opening so as to interfere in any way with the flexibility of the joint.

900.15 Drop Manholes

Drop manholes shall be used when the invert of the inflow sewer is 2 feet or higher than the manhole invert. When this difference of elevation is less than 2 feet, the manhole invert shall be filled and channeled to prevent solids deposition.

Ductile iron pipe on “deep” manholes will be as directed by the City Engineer. Pre-cast drop structure at the base is required.

Due to the unequal earth pressure that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete.

Drop manholes shall be constructed with outside drop connection.

900.16 Test Inspection

The leakage and deflection tests are to be carried out by the contractor after 30 days of installation and witnessed and certified by the City officials and/or their representative.

900.17 Railroad and Highway Crossings

When boring is required, the casing pipe shall be designed to meet the requirements of the local authority having jurisdiction and in compliance with the City of Sidney Construction Standards and Drawings. The size of the casing pipe shall be at least 4 inches greater than the largest outside diameter of the sewer pipe, joints, or couplings.

900.18 Stream Crossings

A. LOCATION OF SEWERS IN STREAMS

1. Cover depth

The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, the following cover requirements must be met:

a) One foot of cover where the sewer is located in rock
b) Three feet of cover in other material. In major streams, more than 3 feet of cover may be required
c) In paved stream channels, the top of the sewer line should be placed below the bottom of the channel pavement.

Less cover will be approved only if the proposed sewer crossing will not interfere with the future improvements to the stream channel. Reasons for requesting less cover shall be provided in the project proposal.

2. Horizontal Location

Sewers located along streams shall be located outside of the stream bed and sufficiently removed therefrom to provide for future possible stream widening and to prevent pollution by siltation during construction.

3. Structures

The sewer outfall, headwalls, manholes, gate boxes, or other structures shall be located so they do not interfere with the free discharge of flow through the stream.

4. Alignment

Sewer crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.

B. CONSTRUCTION

1. Materials

Sewers entering or crossing streams shall be constructed of ductile iron pipe with mechanical joints; otherwise they shall be constructed so they will remain watertight and free from changes in alignment or grades. Material used to

backfill the trench shall be stone, course aggregate, washed gravel, or other materials which will not readily erode, cause siltation, damage pipe during placement, or corrode the pipe.

2. Siltation and Erosion

Construction methods that will minimize siltation and erosion shall be employed. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers in or near streams. Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping of soil or debris, or pumping silt-laden water into the stream. Specifications shall require that cleanup, grading, seeding, and planting or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than 7 days.

900.19 Sewage Pumping Stations

A. GENERAL

1. When sewage pump stations are required, they shall be designed and installed per the following standards:

a) Great Lakes Upper Mississippi River Board (GLUMRB) (Ten States Standards) "Recommended Standards for Wastewater Facilities", latest version.
b) Ohio Environmental Protection Agency's latest requirements.
c) City of Sidney Design Criteria and Standard Construction Drawings.
d) All other applicable codes and regulations.

2. Flooding

The wastewater pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the 100-year flood. Wastewater pumping stations should remain fully operational and accessible during the 25-year flood. Regulations of state and federal agencies regarding flood plain obstructions shall be followed.

3. Individual Grinder Pump

No individual residence or common residence grinder pumps will be permitted. Gravity sewers outletting into a common pump station will be required. Grinder pump and electric alarm system to be maintained by property owner.

B. INTRODUCTION

This pump station design criteria has been developed to provide guidance to land developers, their consulting engineers, and Contractors as to the requirements of the City for design and technical specifications of sewage pumping stations. These requirements are intended to supplement the requirements set forth by the Ohio Environmental Protection Agency (OEPA) and in the following City documents:

1. Developer Installed Improvements Sequence of Events.
2. Standard Specifications for Water and Sewer Construction Projects.
3. Standard Details for Water and Sewer Construction Projects.

There are several general requirements for all new and replacement sewage pumping stations to be built in the City. These include the following:

1. All new and replacement sewage pumping stations shall be fitted with submersible pumps.
2. Typically, new pumping stations will be duplex stations, where each of two pumps will be capable of meeting the station's design capacity. In some cases, larger capacity pumping stations may be required, which shall be constructed with three or more pumps.
3. Where possible, the requirements presented in this document have been developed to address both temporary and permanent installations; however, the City reserves the right to modify the requirements for individual projects as deemed necessary for the protection of public health and/or the environment.
4. In general, ALL pumping stations shall be considered to be permanent unless a project exists on the City of Sidney's 5-year Capital Improvements Plan that would eliminate the pumping station or the Developer has specific plans for eliminating the pumping station within approximately 5 years. However, each pumping station will be reviewed at the inception of design by the City of Sidney to determine whether the pumping station will be considered permanent or temporary for design purposes. If a pumping station is to be temporary (as determined by the City of Sidney), certain requirements may be modified or omitted at the discretion of the Utilities Director of the City of Sidney. In general these modifications and omissions will be as defined in Section M, Temporary Pumping Station.

Wherever the requirements specify "Contractor", they are intended to refer to land developers and their agents, who are typically contractors and their consulting engineers. Nothing in these requirements is intended to assign responsibility contradictory to legitimate contractual arrangements between those parties.

Where these specifications are included with Plans and Bidding Documents for a project publicly bid by the City of Sidney, the Plans and Detailed Specifications shall govern in the event of conflicts between them and this document.

C. SCOPE

The specifications herein given are general and subject to any special provision or requirements set forth in the sections of this document.

1. Scope of Work

   a) The Contractor shall, unless otherwise notified, furnish all labor, materials, equipment, tools, and incidentals necessary to install, test, complete, and make ready for operation a submersible sewage lift station. This includes the furnishing and installation of all necessary and desirable accessory equipment and auxiliaries, whether specifically mentioned in these specifications or not, as required for an installation incorporating the highest standards for the types of service which this lift station is to perform.

   b) These specifications are intended to give a general description of that which is required and do not claim to describe all details of the equipment to be furnished. Such details are considered to be either standard among all manufacturers or variable in accordance with specific equipment formulations, but resulting, in either case, in equipment equal in performance, long-term reliability, and life-cycle cost-effectiveness.

   c) The Contractor shall be responsible for all excavation and removal of obstructions and restoration of all properties involved directly with the construction and/or installation of the lift station.

2. Capacity

   a) The facility shall be sized to handle all flows from the total upstream watershed, except for the pumps, which shall be sized to handle the peak flow of the upstream watershed or twice the design peak flow of the proposed development, whichever is less. However, the facility shall be designed to permit future installation of pumps sized to handle the peak flow of the upstream watershed.

   b) The capacity of a pump station handling flow from existing gravity sewers shall be adequate to manage existing flows, including infiltration/inflow, as well as additional flows anticipated to be required for the proposed development.

3. Design

a) Design of pumping stations shall be coordinated at all stages with the City of Sidney. Plans shall be submitted for review and approval along with water and sewer construction plans.

b) Design efficiency of the pumps shall be submitted for review and approval by the City. Pumps which are not properly selected for efficient operation may be rejected.

4. Responsibilities of Contractor

The Contractor shall be responsible for all materials stored on the job site. The Contractor shall bear the responsibility of any damages incurred either to private or public property.

5. Inspection

Materials provided and work performed shall be subject to inspections by the City representatives and/or by appointed agents of the City. Acceptance of the lift station shall be contingent on the condition that all materials, equipment, and workmanship provided pass set inspections, satisfactory completion of all work, and proper operation of the completed lift station.

6. Warranty

a) A minimum of a full 18-month warranty beginning on the date of acceptance shall be provided for the lift station. The warranty shall cover the following:

l) All equipment, parts, and labor.
2) Site materials, roadways, and fences.
3) Ground subsidence and settlement of valve chamber and wet well.

b) The pumps shall have an l8-month full factory warranty and 5-year prorated warranty (which shall both begin on the date of acceptance of the lift station).

7. Tools and Spare Parts

a) All special tools and recommended spare parts required for normal operation and maintenance shall be supplied for each piece of equipment furnished.

b) The following spare parts shall be furnished as a minimum:

1) One set of one upper and one lower mechanical seals and a seal tool.
2) One set of gaskets, O-rings, grommets, and other sealing devices.

3) One rotating wear ring (if so equipped) or a spare impeller, and one stationary wear ring (if so equipped) or a spare volute.
4) One complete set of spare fuses for all electrical devices.
5) Ten spare bulbs for each lamp type.

c) All tools and spare parts shall be properly packed and protected for long storage and placed in containers clearly identified in permanent markings as to contents. All tools shall be furnished in steel toolboxes.

8. Submittals

a) The Contractor shall submit to the City the following prior to ordering equipment and materials or initiating construction:

l) Certified shop and erection drawings and data regarding pumps, motors, characteristics, and performance. The data shall include guaranteed performance curves, based on actual shop tests of duplicate pumping units, which show that the units meet the specified requirements for head, capacity, efficiency, and input power. Curves shall be submitted in quadruplicate on 8½" x 11" sheets. For pumping units of the same size and type, only curves for a single unit need to be provided.

2) Literature and drawings describing the equipment and showing all important details of construction and dimensions.

3) Complete data on motors, including schematic electrical wiring diagrams and other data as required.

4) Complete schematic electrical wiring diagrams for pumping station, control panel, and telemetry monitoring system.

5) Conduit routing and wire-pulling schedules.

9. Operation and Maintenance Manuals

a) Five complete sets of operating and maintenance instructions shall be provided for all equipment and shall be furnished no later than the date of acceptance. The manuals shall be prepared specifically for the installations to which they pertain and shall include all required catalog cuts, drawings, equipment lists, spare parts, descriptions, etc.

b) The manual for each piece of equipment shall be a separate document with the following specific requirements:

1) Contents:

- Table of contents and index
- Brief description of each system and its components
- Starting and stopping procedures
- Special operating instructions
- Routine maintenance procedures
- Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams
- Instrumentation data sheets with calibration data and specifications
- One copy of each wiring diagram
- Conduit routing and wire-pulling schedules
- One copy of each approved shop drawing and each Contractor's coordination and layout drawing
- List of spare parts, manufacturer's price, and recommended quantity
- Name, address, and telephone numbers of local service representatives

2) Material:

- Loose leaf, on 60-pound punched paper
- Holes reinforced with plastic, cloth, or metal
- Page size, 8½" x 11"
- Diagrams, illustrations, and attached foldouts as required, of original quality, reproduced by dry-copy method
- Covers of oil-, moisture-, and wear-resistant material, 9½" x 12" in size

10. Record Drawings

a) The Record Drawings shall consist of the Contract Drawings, revised per as-built conditions, and the approved Shop Drawings. As-built revisions to the Contract Drawings shall be professionally drafted. The Record Drawings shall be submitted to the City in reproducible form (i.e., 3-mil Mylar) upon completion of the construction.

b) Contract Drawings shall be legibly marked to record actual construction, including:

1) All deviations in location or elevation of any underground installation from that shown on the Contract Drawings

2) Any significant changes in aboveground installations from the approved Shop Drawings or Contract Drawings

3) Indication of City's approval of any such deviations or changes from the Contract Drawings or approved Shop Drawings

c) Specifications and addenda shall be legibly marked to record:

1) Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed

2) Changes made by change order or field order

3) Other matters not originally specified

d) Shop Drawings shall be legibly annotated to record changes made after review.

e) Reproducible Record Drawings shall be submitted within seven calendar days after the date of acceptance.

11. Additional Items

a) Each installation shall be individually assessed as to the need for equipment, structures, procedures, and other items not named or described in these specifications. Installation of these items may be required at the discretion of the Utilities Director or his appointed agent.

b) Any variations from the specifications provided in this document must be approved through the City's representative or the appointed agent of the City.

c) These specifications are subject to change or revision without notification.

D. SUBMERSIBLE PUMPS

The pumps used in all submersible sewage lift stations shall meet the following specifications.

1. Pumps, Motors, and Installation

a) Pumps shall be ITT Flygt CP or equal, shall be capable of passing solids at least 3 inches in diameter, shall have a maximum ambient operating temperature of at least 115° F, and shall be capable of withstanding corrosive materials normally found in domestic and industrial waste.

b) Pump motors shall be 460/480 volt AC, 3-phase, 60 Hz or 220/240 volt AC, 3-phase, 60 Hz, depending upon site constraints, power availability, and

pump size and application requirements. The need for dual-voltage motors which are field changeable shall be considered on an individual basis dependent on pump size, location, and other factors.

c) A nameplate of 316 stainless steel shall be attached to each pump, giving the name of the manufacturer, rated capacity, head, speed, model number, serial number, and all other pertinent data.

d) All anchor bolts shall be of 316 stainless steel.

e) Each pump shall be provided with a sufficiently long power cable to suit its installation without splicing. The power cable shall be type SPC cable, chloroprene rubber-jacketed, and suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and shall also meet with P-MSHA approval. Each power cable shall be installed in a separate conduit to the control panel.

f) A 316 stainless steel lifting chain shall be provided for each pump, of sufficient length to reach from the pump attachment to a chain holder, furnished by the equipment manufacturer, and installed near the upper guide rail support for that pump. The chain shall be of sufficient strength to allow the raising and lowering of the pump with a safety factor of at least 5, but in no case less than 5/16 inch chain links.

g) The pump shall be supplied with a mating cast-iron discharge connection elbow. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. There shall be no need for personnel to enter the wet well to install, remove, or maintain the pumps.

h) Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by no less than two guide bars and shall be pressed tightly against the discharge connection elbow with metal-to-metal contact. Sealing of the devices by any other means shall not be acceptable. No portion of the pump shall bear directly on the floor of the wet well, and the minimum clearance specified by the manufacturer shall be maintained with at least 4 inches in all cases. The pump, with its appurtenances and cable, shall be capable of continuous submergence under water to a depth of 65 feet without loss of watertight integrity.

i) Major pump components shall be of gray cast iron with smooth surfaces devoid of blow holes and other irregularities. All exposed nuts and bolts

shall be of AISI-type 304 stainless steel or brass construction. All surfaces which will come into contact with sewage, other than stainless steel or brass, shall be protected by an approved sewage-resistant coating. The impeller shall be factory-coated with acrylic dispersion zinc phosphate primer. The pump exterior shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish.

j) All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This shall result in controlled compression of the O-rings without the requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease, or other devices shall be used.

k) The design of the cable-entry water seal shall ensure a watertight and submersible seal. A single-cable entry to the pump housing shall contain all leads. The cable entry shall be comprised of a single-cylindrical elastomer grommet, flanked by stainless steel washers, all having a close-tolerance fit against the outside diameter of the cable and compressed by the entry body containing a strain-relief function, separate from the function of sealing the cable. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall protect the interior of the motor from foreign material which might gain access through the top of the pump. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable. The pump supplier shall provide a watertight connector, equal to a Crouse Hinds type CGB with a neoprene gland to terminate the cable in the pump disconnect.

l) The pump motor shall be designed and manufactured by the same manufacturer as the pump. The pump motor shall be of a squirrel-cage, induction, shell-type design, housed in an air-filled, watertight chamber. The stator winding and stator leads shall be insulated with moisture-resistant Class F insulation which shall resist a temperature of 155° C. The stator shall be dipped and baked three times in Class F varnish and shall be fitted into the stator housing by heat-shrinking. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing shall not be acceptable. The motor shall be designed for continuous duty, capable of sustaining a minimum of ten starts per hour with the liquid surface located at the top of the pump's volute, but below the motor casing, with a temperature rise not exceeding 40° C above ambient temperature.

m) The junction chamber, containing the terminal board, shall be sealed from the motor by an elastomer compression seal (O-ring). Connection between the cable conductors and stator leads shall be made with threaded, compressed-type binding posts permanently affixed to a terminal board.

n) Each motor 14 horsepower or larger shall be provided with an adequately designed cooling system, consisting of a water jacket encircling the stator housing. The water jacket shall be provided with a separate circulation of the pumped liquid. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Systems that utilize a closed loop cooling system such as ethylene or propylene glycol or oil shall not be acceptable.

o) Thermal sensors shall be used to monitor stator temperatures on all pumps. The stator shall be equipped with three normally open thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase).

p) Each pump shaft shall be of either stainless steel or carbon steel C1034 and shall be completely isolated from the pumped liquid.

q) Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The upper of the tandem set of seals shall operate in an oil chamber located just below the stator housing. This set shall contain one stationary tungsten carbide ring and one positively driven rotating tungsten carbide ring and shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring, both of which shall be of tungsten carbide. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The following seal types shall not be considered acceptable nor equal to the dual independent seals specified:

    1) Shaft seals without positively driven rotating members.

    2) Conventional double mechanical seals containing either a common or double spring acting between the upper and lower units (this conventional system requires a pressure differential to offset external pressure and effect sealing).

r) The only functions of the oil chamber shall be as a secondary barrier between the pumped liquid and as a seal lubricant. It shall be designed to compensate for oil expansion that can occur due to temperature variations. Drain and inspection plugs, with positive sealing, shall be easily accessible from the outside.

s) The pump shaft shall rotate on two permanently-lubricated bearings. The upper bearing, providing for radial thrust, shall be a single-row roller bearing. The lower bearing shall be a two-row, angular contact bearing to compensate for axial thrust and radial thrust.

t) The impeller shall be of a gray cast-iron, dynamically-balanced, double-shrouded, non-clogging design having a long throughlet without acute turns. The impeller shall be capable of handling grit, solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The pump manufacturer shall furnish data on mass moment of inertia for the proposed impeller. The fit between the impeller and the shaft shall be a sliding fit with one key, and the fastening of the impeller to the shaft shall be made by a locking assembly which is sealed from the liquid by a protective rubber cap and a bolt threaded to the shaft terminal.

u) The volute shall be of a single-piece, non-concentric design and shall have smooth fluid passages large enough at all points to pass any solids which can pass through the impeller. The volute bottom shall be of a suction-bell design. A replaceable wear-ring system shall be installed to provide efficient sealing between the volute inlet and the impeller skirt. The wear rings shall consist of a stationary brass wear ring in the volute. Pumps 14 horsepower or larger shall also have a rotating stainless steel wear ring on the impeller skirt.

v) Cable support shall be provided for the pump power cable and shall consist of a wire braid sleeve with attachment tails for connection to supports furnished by the equipment manufacturer and installed in locations indicated in the manufacturer's drawings and approved by the Engineer.

w) A mix-flush system shall be provided for each pump. The mix-flush system shall be equal to an ITT Flygt 4901 flush valve. The valve shall use the ejector principle, in which water exiting the valve shall violently agitate the liquid in the sump, thereby re-suspending any accumulation of sludge. The flushing period of the valve shall be adjustable. The direction of discharge from the mix-flush system shall be adjustable in 360° to any part of the wet well.

x) Pump removal equipment shall meet the following specifications:

    1) Lift stations supplied with pumps weighing 800 pounds or less shall be supplied with sockets at each pump and a single portable stainless steel winch-type hoist system capable of pulling either pump completely out of the wet well. The winch and hoist shall be rated at twice the

maximum weight of the pump. The hoist shall be fitted with a static loop and screw pin anchor shackle to support the weight of the pump while regripping the chain with the winch hook. Hoist shall be Halliday Products Series DB or equal.

2) Lift stations equipped with pumps weighing in excess of 800 pounds shall have a derrick-type lifting system. This system shall be designed so as to allow lifting, moving, and loading of pumps onto the bed of a standard one-ton truck. The lifting system and the structural design of the derrick shall be rated at a minimum of twice the weight of the heaviest pump installed in the station. The lifting system shall be supplied with a means of operating electrically for both lifting and rotating. A galvanized steel shield shall be attached to the jib to shield the trolley when not in use.

2. Mounting Hardware

All slide rails shall be made of 316 stainless steel and shall be of tubular design. Upper guide bar brackets, middle support brackets, and float hangers shall also be made of 316 stainless steel. All other hardware (bolts, nuts, etc.) shall similarly be made of 316 stainless steel.

3. Additional Equipment

All pumps shall be equipped with seal leak detectors, so as to give adequate warning if the lower seal unit should fail and shall be a ITT Flygt MINICAS II brand.

4. Shop Testing of Pumps

a) All pumps of 35 horsepower capacity or greater shall undergo certified testing at the factory for capacity, power requirements, and efficiency at specified extremes for rated head, shutoff head, and operating head, and at as many other points as necessary for accurate plotting of performance curves, with the completely assembled pump and motor that will be furnished.

b) All tests and test reports shall be made in conformity with the requirements and recommendations of the Hydraulic Institute Standards.

c) Copies of the test logs, a description of the test piping, equipment, and set-up, and a discussion of the test procedure shall accompany certified test performance curves and shall be submitted to the City. The curves shall include head, bhp, overall (wire-to-water) efficiency, rpm, and test NPSHRe

plotted against capacity. The curves shall be easily read and plotted to scales consistent with performance requirements.

E. WET WELLS AND VALVE PITS

Wet wells and valve pits shall be constructed as required, in accordance with the following specifications:

1. Wet Well and Valve Pit Construction

   a) Wet wells shall be constructed using either precast concrete sections or poured-in-place concrete. If precast construction is used, each section shall be set and sealed with the proper gasket and joint sealing compound approved by the City. If the lift station will be constructed of poured-in-place concrete, the concrete shall be reinforced with reinforcement rod in accordance with acceptable engineering design practice and shall be certified by a Professional Engineer registered in the State of Ohio.

   b) Either type of construction shall have a foundation designed so as to adequately support the station. At least one subsurface test boring shall be made at the lift station site to at least five feet below the proposed bottom of the wet well. A complete soil analysis including ground water level shall be submitted with the plans. Soil analysis shall include at least Standard Penetration Tests (ASTM D 1586); classification of soils' textures and consistencies; tests for natural moisture content; engineering classification of predominant soil horizons (including sieve and hydrometer analysis (ASTM D 422), Atterberg limits (ASTM D 4318), and specific gravity (ASTM D 854); and determination of Rock Quality Designation values. This analysis shall be used by the design engineer to verify that adequate ground support exists for the station as well as to design the structure to prevent flotation. This design shall be certified by a Professional Engineer registered in the State of Ohio.

   c) Plans shall indicate the elevation of the 100-year flood plain at the lift station site. The tops of the wet well and valve pit, as well as the generator and control panel pads, shall be at least 1 foot above the 100-year flood plain.

   d) Design shall be such that a 30-minute cycle time for each pump (i.e. 15-minute overall cycle time for duplex stations; 10-minute overall cycle time for triplex stations) shall be obtained at average design flow. The wet well shall also incorporate a design sufficient to provide at least 1 hour of storage at twice the ultimate average flow from the high-water alarm to the invert of the influent sewer. In no case shall this distance be less than 6 feet.

e) No more than one influent sewer shall enter the wet well, and it shall be located opposite the pumps. The last manhole before the wet well shall be located within 10 feet of the wet well and shall be either within the fence or near one of the fence gates.

f) Wet wells shall have a minimum inside diameter of 6 feet. Valve pits shall have a minimum inside dimension in all directions of 6 feet. Valve pits shall have an inside depth of no more than 8 feet.

g) Each valve pit shall be fitted with a drainage system such that any liquid entering the valve pit will be drained back to the wet well. Drainage of the valve pit shall be ensured by a l-degree slope to the floor of the valve chamber draining to the invert of a drain line fitted with a check valve to prevent sewage from entering the valve chamber. The drain line shall be a minimum 2-inch diameter constructed of Schedule 80 PVC, and the check valve shall be constructed of PVC. The check valve should be attached to the drain pipe with a NPT threaded joint to permit changing the valve. The pipe shall extend at least 12 inches into the wet well but shall not interfere with pump removal. The check valve shall be normally closed, or a "P" trap shall be placed in the drain line to prevent vapors from entering the valve pit.

h) Each valve pit shall also be furnished with a valved connection to the forcemain beyond the pump isolation valves for emergency pumping. This connection shall be sized to equal the discharge piping from the pumps and shall have a minimum diameter of 4 inches. This connection shall be equipped with a 4-inch galvanized steel Bauer fitting for ease of hose connection. If the valve is larger than 4 inches, a reducer or blind flange with a 4-inch threaded tap shall be installed for connecting the Bauer fitting. Bauer fitting and accessories shall be as follows, with one discharge connection, one rubber sealing ring, and one end cap.

Part Numbers

Size & Type	Discharge Connection	Lever Ring	HK Rubber Sealing Ring	End Cap
4" Flanged	100-6987	included	105-0140	105-0201
4" Threaded	105-0811	105-0134	105-0140	105-0201

i) All pipe and conduit penetrations through the wet well and valve pit structures shall be sealed with Dura-seal rubber compression gaskets, rubber Link Seal sleeves with stainless steel components, or approved equal products. All voids should be filled with non-shrink grout on both sides of the wall.

j) The wet well shall be provided with at least one "gooseneck" inverted vent pipe appropriately sized. The piping shall be made of epoxy-coated ductile iron, aluminum, or other corrosion-resistant material and shall be the same size as the largest pump discharge piping (minimum 4 inches). Black iron pipe will not be allowed. Also, PVC or other plastic pipe will not be allowed. The exterior end of the pipe shall be covered with a stainless steel screen.

k) Adequate waterproofing of the wet well and valve pit shall be included in the design and performed by the Contractor. A leakage test shall be performed on the entire wet well and valve pit prior to backfilling (see Section 3.2). The Contractor/Developer shall be responsible for properly repairing any leaks or correcting any other problems discovered during this test.

l) All valve pits shall be fitted with either an aluminum ladder or polypropylene manhole steps for access. An aluminum Bilco Ladder-Up safety post or equal shall be provided as well.

2. Leakage Testing of Wet Well and Valve Pit

Wet well and valve pits shall be tested for leakage prior to backfilling as follows.

3. Backfill and Embankment

a) The Contractor shall provide all labor, materials, tools, equipment, and incidentals required to place the compacted backfill or embankment where shown on the plans or where directed by the Engineer and as specified herein.

b) Compacted backfill and embankment shall consist of suitable excavated material approved by the Engineer or granular backfill meeting O.D.O.T. Item 603, Type 2. This material may be obtained from suitable excavated material elsewhere on the project, if available. Use of frozen material, wood, rocks, or rubbish for backfill or embankment will not be permitted. If suitable material cannot be obtained from the excavated material, the Contractor shall furnish the material.

c) No fill shall be placed covering other work until such work has been inspected and approved by the Engineer. Where fill is required on both sides of a foundation or wall, the fill shall be placed simultaneously on each side. Fill against building walls shall not be placed until the first floor slab has been poured and set, unless otherwise approved by the Engineer. Fill against other work shall be in a manner and at such time as not to endanger the

stability of or damage the work. No fill shall be placed against water bearing walls until they have been inspected, tested, and approved by the Engineer. No fill shall be placed over snow or frozen material.

d) All fill shall be compacted as specified herein, unless otherwise shown.

1) Backfill. Backfill shall be placed in 6-inch loose layers and each layer compacted to not less than 95% of maximum dry density; the moisture content shall be not greater than 3 percentage points above optimum as determined by ASTM D 698. Compaction shall be accomplished with a vibratory double-drum steel wheel roller no less that 2.0 tons and no greater than 3.0 tons or by other means approved in writing by the Engineer. Flushing with water before compacting is also encouraged if satisfactory drainage is provided for the free water. The method of compaction within road rights-of-way shall be approved by the City of Sidney Engineer's Office or O.D.O.T., as appropriate.

2) Embankments. Embankment areas shall be constructed in accordance with this specification. Embankment fill shall be placed in 6-inch loose layers and each layer compacted to not less than the percent of maximum dry density specified herein; the moisture content shall be not less than optimum and not greater than 3 percentage points above optimum. For material which displays pronounced elasticity or deformation under action of compaction equipment, the moisture content shall be reduced and proper stability obtained. Moisture density shall be as determined by ASTM D 698.

Maximum Dry Density (lbs/cu ft)	Compaction Percent Maximum Dry Density
90-104.9	102
105-119.9	100
120 and more	98

3) Subgrade. All pavement subgrades for new pavement shall be compacted to a depth of 12 inches. Subgrade soils with a maximum dry density of less than 100 pounds per cubic foot are considered unsuitable for use where subgrade compaction for a depth of 12 inches is required, and when encountered in the upper 12 inches of the subgrade shall be replaced with suitable soil or granular material. Soil subgrade with maximum dry density of 100 to 105 pounds per cubic foot shall be compacted to not less than 102% of maximum dry density. All other soil subgrade shall be compacted to not less than 100% of maximum dry density; the moisture content shall be not greater than 3 percentage points above optimum as determined by ASTM D 698.

e) The Contractor shall obtain up to three soil samples where directed by the Engineer and transport the samples to an approved testing agency for Standard Proctor dry density testing (ASTM D 698). In addition, the Contractor shall cause a trained and experienced soil technician from an approved testing agency to be onsite during all backfill and embankment placement and to conduct at least three field density tests for every vertical foot of backfill or embankment placed. The Engineer shall review and approve the field density test reports at least every five vertical feet of embankment, and placement of embankment may not continue without this approval.

4. Wet Well and Valve Pit Lids and Accessories

a) Wet well and valve pit lids shall be composed of .25-inch-thick aluminum rated at 150 pounds per square foot (300 pounds per square foot in traffic bearing situations or if top of structures are not elevated at least 6 inches above grade). Lids shall be affixed with stainless steel hinges and hardware. A retractable handle constructed of stainless steel shall be furnished with each lid--such that when the lid is closed, there shall be no protrusions above the lid level.

b) The channel frame shall be ¼ inch minimum aluminum with anchor flange around the perimeter with a drain into the wet well.

c) Factory finish shall be mill-finish with bituminous coating applied to the exterior of the frame.

d) Each lid shall be furnished with a stainless steel padlock tab for securing the lid, a stainless steel snap lock with gasketed, threaded cover plug and removable key wrench, and a stainless steel hold-open arm with release handle for securing the lid in a 90-foot open position. Also, compression-spring operators enclosed in telescopic tubes shall be provided for smooth, easy, and controlled door operation throughout the entire arc of opening and closing.

e) Pump access lids shall be sized according to the pump manufacturer's recommendation. Access hatch(es) on the valve pit shall be large enough to permit easy installation and removal of the check valves and gate valves, as well as permit access to the Bauer connection. Every structure shall have at least one access lid with a minimum size of 30 inches by 30 inches that will permit entry of maintenance personnel wearing self-contained breathing apparatus.

f) Access lids over the pumps in the wet well shall lift away from the pump guide rails (i.e. toward the influent sewer).

g) Access to the control panels shall meet National Electric Code (NEC) conditions with the lids in the 90° open position.

h) Aluminum access lids shall be as manufactured by Bilco or approved equal.

F. PIPES, ISOLATION VALVES, CHECK VALVES, AND SURGE RELIEF VALVES

All pipes and related equipment shall conform to the following specifications:

1. Pipes

a) The forcemain and other piping at the pumping station shall be a minimum of 4 inches in diameter. Pipes shall be of Class 53 ductile iron meeting ANSI/AWWA Cl51/A21.51. All pipes shall be cement-lined, meeting ANSI/AWWA C104/A21.4 standards with asphaltic seal coating on the interior.

b) All mating ends in the lift station and valve pit shall be Class 125 flanged meeting ANSI/AWWA C110/A21.10 and C115/A21.15, with a gasket no larger than 0.125 inch between flanges. Flange adapters such as Union Flange will not be allowed. All flanges shall be ductile iron, not gray iron. All flange bolts shall be 316 stainless steel. Exterior of pipes in the wet well and valve pit shall be coated with epoxy-based paint, in accordance with AWWA standards. Only one joint or fitting will be permitted on each pipe between the wet well and the valve pit. This shall be a restrained flexible joint such as a mechanical-joint solid sleeve with MegaLugs. No flanged joints will be permitted outside the wet well and valve pit.

c) Each pump discharge line shall have a pressure gauge with a lever-operated ball valve installed in the valve pit between the check valve and the gate valve. The gauges shall be stainless steel glycerin-filled diaphragm gauges suitable for raw sewage service. Gauges shall have at least a 2½-inch face with a polycarbonate window and a full scale pressure of twice the shut-off head of the pump. Connections shall be NPT brass or stainless steel with a stainless steel snubber between the valve and the gauge. Ball valves shall be lever operated stainless steel with vinyl grip handles and NPT connections. Valves shall be rated for at least 350 psi working pressure. Piping shall be stainless steel or brass with a minimum pressure rating of 200 psi. Hydrostatic tests shall be performed with ball valves turned off.

d) Forcemain piping shall have standard push-on bell and spigot joints meeting ANSI/AWWA Cl51/A21.51 and shall be installed in accordance with ANSI/AWWA C600. Exterior of piping shall be coated with standard asphaltic coating. Ring gaskets shall be of approved composition suitable for the required service. Fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10. Piping at all bends and at both ends of the forcemain shall be restrained with flexible restrained push-on joints conforming to ANSI/AWWA C153/A21.53 or C111/A21.11 or other approved restrained joints for sufficient lengths to withstand the higher of the test pressure or the operating pressure plus a reasonable surge allowance. Substitution of concrete thrust-blocks in accordance with AWWA and the City standards in lieu of restrained joint pipe will be considered on a case-by-case basis.

e) Forcemains shall have a minimum cover of 4 feet and a maximum cover of 12 feet. High points in the forcemain should be minimized by the use of deeper cuts through small hills along the alignment. Automatic air release valves shall be located at each high point on the forcemain. The forcemain shall discharge at an elevation not more than 2 feet above the invert of the receiving sewer, to a separate terminal manhole having no upstream gravity sewer connections.

2. Isolation Valves

a) Each pump discharge line shall be furnished with an individual isolation valve. Isolation valves shall also be furnished for the Bauer connection and on the common forcemain before exiting the valve pit. The possibility of locating a buried valve outside the valve pit shall be considered on a case-by-case basis.

b) Isolation valves shall be of the resilient-seat gate type and shall be as manufactured by Clow Corporation, American Flow Control, Kennedy Valve, M & H Valve, or equal.

c) Gate valves shall conform to the requirements of AWWA C509 as applicable.

d) Valves shall be furnished with Class 125 flanged ends.

e) All-metal valves shall be manufactured of ASTM A126 cast iron, Class B, with bronze mounting hardware.

f) Valves shall be of the non-rising stem type, using a double O-ring stem seal, except that packing shall be used when gear operations are required.

g) Valves shall be rated for the following working pressures:

Valve Size	Pressure (psig)	Class
3 inch to 12 inch	200	125
14 inch to 20 inch	150	125

Piping and valves larger than 20-inch diameter shall be individually designed.

h) All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed 1 fluid ounce per inch of valve diameter per hour. A certificate of testing shall be provided.

i) Flanged valves shall have face-to-face dimensions in accordance with ANSI B16.1 and flanges in accordance with ANSI B16.10.

j) All bonnet and packing gland bolts shall be steel, electro-plated with either zinc or cadmium; packing gland bolts shall have bronze nuts.

k) Valves shall be furnished with handwheels as well as geared operators where required to produce the specified torque with a maximum pull of 80 pounds on the handwheel.

l) All valves shall be marked in accordance with AWWA standards, including the name of the manufacturer, valve size, working pressure, and year of manufacture.

m) Valves shall open counter-clockwise and close clockwise. Permanent labels shall be provided for each valve, showing both the "Open" position and indicating arrows.

n) Resilient-seated valves shall be coated, interior, exterior, and valve bonnet, with fusion-bonded epoxy, in accordance with AWWA C550.

o) Valves shall be UL- and FM- approved.

p) Each valve gate shall be encapsulated with synthetic rubber which has been bonded and vulcanized in accordance with ASTM B429, Method B.

q) Recesses in the valve body shall not be permitted.

3. Check Valves

a) Check valves for ductile iron pipelines shall be swing-type and shall meet the material requirements of AWWA specification C508 swing-check valves for ordinary waterworks service. The valves shall be of cast-iron body, bronze-mounted, single-disc 175 psi working water pressure, non-shock, and hydrostatically tested at 300 psi. Valve ends shall be 125 pound ANSI B16.1 flanges. Interior and exterior of valve body shall be coated with fusion-bonded epoxy in accordance with AWWA C550.

b) When there is no flow through the line, the disc shall hang lightly against its seat in a vertical position. When open, the disc shall swing clear of the waterway.

c) Check valves shall have bronze seat and body rings, extended bronze hinge pins, and bronze nuts on the bolts of bolted covers.

d) Valves shall be fitted with an extended hinge arm with outside lever and weights. Valves shall be so constructed that disc and body seat may be easily removed and replaced without removing the valve from the line. Check valves shall thus be installed with enough clearance between the valves and the walls of the valve pit to permit removal of the shaft for maintenance purposes.

e) Check valves in pump stations with total head in excess of 50 feet shall be equipped with a hydraulic cushion to dampen the last 10% of the valve closing action. The hydraulic cushion chamber shall be arranged so that the valve closing speed is adjustable to meet the service requirements.

f) All check valve shafts shall be designed to accept a hydraulic cushion in case future modification is desired.

4. Surge Relief Valves

a) On all pump stations with a total dynamic head in excess of 50 feet, the need for a surge relief valve shall be considered. The surge relief valve shall be designed to prevent damage to any piping, valves, or other equipment in the event of a power failure during operation of all pumps in the station.

b) Any surge relief valve shall be installed in the valve pit with discharge into the wet well.

c) The surge relief valve shall meet the same material and pressure-rating requirements as the check valves. Surge relief valve design and construction shall be approved by the City.

G. ELECTRICAL

1. All electrical components shall meet NEMA standards, and shall comply with NEC as applicable to construction and installation of wiring and components. The electrical system inside the wet well shall comply with the National Electric Code for Hazardous Locations, Class 1, Group D.

2. An enclosure shall be provided to house all electrical equipment outlined in the following specifications. The enclosure shall be located on a separate concrete pad adjacent to the wet well. The pad shall be of sufficient size to support the enclosure and provide access in accordance with NEC requirements.

3. The enclosure and the electrical equipment which shall be supplied with each sewage pumping station are described in this section.

4. Each lift station shall have a minimum of a 175 wall metal halicle or mercury vapor light on photocell mounted high enough to light up lift station area.

5. Enclosures

    a) The enclosure shall contain both the motor control panel and the telemetry monitoring system. The enclosure shall have room for the remote terminal unit (RTU) even if the initial installation of the telemetry monitoring system is waived by the City. The RTU shall be isolated from the motor control panel. Hardwire controls must be kept away from the RTU (or the space reserved for a future RTU) to prevent electrical noise interference.

    b) Enclosures supplied with each station shall be Hoffman #A-62H4812SSLP or equal (or appropriately-sized equivalent, if larger enclosure is required) and shall be rated NEMA Type 4X. The enclosure shall be large enough to provide an unused space equal to at least 30% the space required. This space shall be reserved for installation of future equipment by the City, and no wiring or controls shall intrude into this reserved space. The construction shall be of 304 stainless steel, in accordance with ASTM A167, and shall be supplied with a drip shield, a continuous hinge on the panel, and smooth seamless sides.

    c) The enclosure shall include add-on kits equal to the Hoffman kits listed by catalog number below:

        1) D-L3630SOP Swing Out Door Kit (for mounting indicator lights and operator entry switch).
        2) ADSTOPK Door Stop Kit.
        3) XLF16D18 Door-Activated Light.

d) Each enclosure shall have a door-in-door arrangement. The circuit breakers, control switches, pilot lights, etc., shall be accessible to the operator from the inner panel. The outer panel shall be void of control devices.

e) The outer panel doors of the enclosure shall be secured as follows:

1) The right-hand door shall be secured with Hoffman latch, Cat. #A-L2CR.

2) The left-hand door shall be secured with Hoffman latch, Cat. #A-L2CCCW.

3) Panel doors shall also be provided with stainless steel hasp and eye or tabs for securing with a padlock.

f) Subpanels shall also be stainless steel.

g) Each sewage pumping station enclosure shall be provided with one duplex service outlet of 120-volt AC, 20-amp rating. This outlet shall be supplied from the control transformer and shall have GFCI circuit protection. The outlet shall be located in the motor control panel.

h) All wiring and components shall be tag-numbered and/or clearly marked in accordance with the drawings and as directed by the Engineer.

i) The motor control panel shall be UL-listed or listed by another nationally recognized testing agency and shall be built in accordance with NFPA 79 Electrical Standards for Industrial Machinery.

j) An outline drawing of the control panel shall be provided, showing panel elevation, dimensions, and weight. Interconnecting wiring diagrams shall be provided, which show all electrical connections between field-installed equipment and the control panel. Schematic control wiring diagrams shall be provided, showing all control components, switches, pilot lights, relays, etc. The wiring diagrams shall indicate wire and terminal numbers. Each component shall be uniquely labeled.

6. Circuit Breakers

a) All circuit breakers shall be of the thermal-magnetic type, with molded case breakers. Breakers shall be UL-listed and CSA-certified, and shall meet Federal Specification W-G-375B/GEN.

b) Three-pole breakers shall be manufactured by Cutler/Hammer Series C and shall have a short-circuit rating equal to 125% of the available fault current. Regardless of the available fault rating, circuit breakers shall not be less than Style FA for applications under 100 amps, or Style KA for applications between 100 and 250 amps.

c) Single-pole breakers shall be Cutler/Hammer Series C and shall be used for control circuits and peripheral devices.

d) A main service entrance-rated circuit breaker shall be provided for the control panel, with separate circuit breakers for each motor and transformer primary and secondary, as well as single-pole circuit breakers for control circuitry, RTU, lighting, and outlets.

e) Circuit breakers shall be accessible to the operator from the subpanel without having to come in contact with open wiring. The main and motor branch circuit breakers shall be lockable.

f) A minimum of two spare 120-volt AC, 15-amp circuit breakers shall be provided and mounted on the panel.

7. Starters

a) Motor starters shall be Cutler/Hammer Advantage Series. They shall be equipped with three poles and shall be provided with auxiliary contacts for status inputs to the telemetry monitoring system. Thermal overload relays shall be Cutler/Hammer solid state adjustable thermal overloads or equivalent.

b) Starters shall conform to all NEMA ratings. The minimum size starter shall be NEMA 1.

c) Where required by a local power company or the City, electronic soft-start starters, as manufactured by Cutler/Hammer IT Soft Starts shall be supplied.

d) Provisions for sequential pump starting shall be made in the controls to prevent more than one pump from starting simultaneously.

8. Control Transformers

a) Control transformers shall be internal mounted. Primary voltage shall be 480/240 volt AC and secondary voltage shall be 120 volt AC.

b) The transformer should be sized for the power requirements of the pumping station or shall have a minimum output current rating of 30 amps. The transformer shall be protected by circuit breakers on the primary and secondary sides.

9. Control Relays

a) All control relays shall be of the 8- or 11-pin octal plug-in type, Cutler/Hammer or equivalent. Relays may be either direct panel-mounted or DIN rail-mounted. Control relays shall be of at least DPDT configuration.

b) Intrinsically safe relays shall be provided for operation with the wet well float switches. Wiring associated with the intrinsically safe relays shall be segregated from other power and control wiring.

10. Duplex Alternator

a) The alternating relay shall be as manufactured by ITT Flygt Part No. 008-120-13SP.

b) The above describes a duplex alternator. Pumping stations with three or more pumps shall have an alternator capable of equalizing operating hours among the pumps.

11. Multitrode (By Flygt)

a) A multitrode level controller will be used to control the lift stations pumping and alarms. (Flygt Model 3.0/10-100).

b) In a dual pump station Flygt MTR-3 and MTRA-3 controllers will be used for pump control and alarm.

c) In a three-pump station, two Flygt MTRA-3 controllers will be used for pump control and alarm.

d) A multitrode MTAK-2 will be included to provide 12 inches of extra wall clearance and provide a probe cleaner.

e) The multitrode will provide an OFF pump signal, lead pump signal, lag pump signal, and a high-level alarm which ties into local horn and strobe as to a telemetry system.

12. Switches and Pilot Lamps

a) All lamps shall be of the transformer type.

b) Switches and pilot lamps shall be oil-tight and shall meet NEMA standards for A600 heavy-duty contacts. Each pump shall have a separate selector switch with the following settings: ON -- OFF -- AUTO. Each pump shall also have a pilot lamp to indicate when the pump is running. These switches and lights should be located inside the control panel.

c) All HOA switches and pilot lamps shall be as manufactured by either Furnas or Allen-Bradley. Switches and pilot lamps shall be oil-tight and shall meet NEMA standards for A600 heavy-duty contacts.

13. Over-Current Relays

a) Over-current relays shall be provided and shall be wired so that every motor lead passes through the current loops. When motor current exceeds 50 amps, current transformers shall be available to satisfy the current requirements (i.e. current shall be reduced to below 50 amps for monitoring purposes).

b) Output contacts for a remote alarm shall be provided.

c) The over-current relays shall be SSAC Model No. ECS41BC or equivalent for pumps with full-load current up to 20 amps or SSAC Model No. ECSH4HBD for pumps with current rating above 20 amps.

14. Voltage Monitors

a) A voltage monitor shall be supplied to monitor the incoming voltage from the local power company. This unit shall be manufactured by SSAC, Model No. WVM011A* or equal. The monitor shall be rated at either 240 volt AC or 480 volt AC, according to the incoming voltage source. Voltage monitor shall monitor all incoming phases. Protection of the voltage monitor, on the incoming voltage, shall be through l-amp fuses.

b) When an under-voltage condition occurs, an alarm shall be sent via the telemetry monitoring system after an adjustable time delay.

15. Wire and Cable

a) All wiring and cable installation shall conform to NEC regulations and shall comply with local codes. All conductors shall be copper. Wiring shall not be operated above 75° C.

b) For electrical equipment feeders (motor control centers, motor branch circuits, etc.) located below grade or for exterior control and motor circuits,

wiring shall be type THHN through #2 AWG and type RHH for larger than #2 AWG.

c) For branch circuits for lighting and receptacles, wiring shall be type THHN in conduit. For branch circuits for interior control, wiring shall be type MTW.

d) Power wiring shall be 12 AWG minimum and control wiring shall be 14 AWG minimum.

e) For instrumentation (i.e. 4-20 mA signals), cables shall be 16 AWG copper, NEC-type TC rated at 600 volts (Belden No. 1118A or equal) individually-shielded twisted pair cable. All digital signal wires may be of the type of wire specified above.

f) All telemetry monitoring system and signal wires shall be in conduit separate from any AC power lines. All motor circuits must be in separate conduits apart from any lighting, receptacle, or control wiring.

g) All conductors shall be sized such that voltage drop does not exceed 3% for branch circuits or 5% for feeder branch circuit combinations.

h) The use of pulling compound shall be required in all installations of wire pulled in conduit as needed. All conduits shall be sized in accordance with NEC regulations and/or local codes.

i) Fork-tongue compression terminals shall be installed on all control and metering conductors connected to terminal blocks. All terminations shall be coated with a UL-listed anti-oxidation compound.

16. Raceways and Conduit

a) All conduits shall be of one of the following types:

1) Rigid steel, which shall be hot-dipped, galvanized, threaded-type conduit, conforming to FS WW-C-581E, ANSI C80.1. Rigid steel conduit shall only be used for interior conduits.

2) Rigid aluminum, which shall comply with NEC and local codes. Rigid aluminum conduit shall not be used for buried conduits.

3) PVC plastic, which shall be Schedule 80. All PVC conduit shall comply with NEC and local codes and have glued joints. PVC conduit shall not be used for interior conduits, but shall be used for all buried conduits and may be used for exterior conduits.

4) Liquid-tight, which shall be flexible steel conduit with a high tensile strength galvanized steel core and continuous copper ground built into the core. This conduit shall have a smooth non-wrinkling PVC jacket that will not pull away from fittings. This conduit shall be type LA Liquatite as manufactured by Electri-flex, or equal. Liquid-tight conduit shall be used for any final runs into instrumentation equipment and shall not exceed 18 inches in length.

b) Conduits between the wet well and control panel shall have a minimum size of 2 inches and shall be as follows:

1) One conduit for each pump
2) One conduit for future mixer or influent grinder (spare)
3) One conduit for high high-level float (telemetry monitoring system)
4) One conduit for remaining floats.

c) All conduits shall be tagged and identified with brass tags held on by copper wire at both ends.

d) Conduit routing and wire-pulling schedules shall be submitted with shop drawings.

17. Grounding

All submitted site plans shall show a grounding scheme. Grounding shall comply with NEC requirements.

18. Security System Devices

a) Security system devices shall be furnished and installed as described below.

b) All wet well and valve pit hatches shall have a limit switch on each exterior door. Limit switches shall be Cutler/Hammer or equal. All such switches shall be connected to the site entry input point on the telemetry monitoring system.

19. Nameplates

a) Engraved nameplates shall be provided for every circuit breaker, control switch, pilot light, etc. Nameplates shall be white-faced tags with engraved black letters. Letters shall be ⅛ inch in height.

b) Nameplates shall be attached to the panel by means of stainless steel machine screws.

20. Line-Surge Protection

    A lightning arrester and line-surge capacitors shall be provided on the incoming power lines. The lightning arrester shall be of the 650-volt, 3-phase, “Transquell" type, as manufactured by General Electric Co., Cat. No. 9L15ECC001, or equal. Line-surge capacitors shall be 650-volt, 3-phase, non-toxic liquid-insulated, as manufactured by General Electric Co., Cat. No. 9L18BAB301, or equal. The lightning arrester shall be mounted outside the control panel.

21. Local Alarm

    a) An audible and a visual alarm shall be mounted on the enclosure. Mounting the alarm on the top or front of the panel shall not be acceptable. Specific site conditions shall dictate the orientation of the alarm and panel.

    b) The alarm light shall be visible from 360°.

    c) The local alarm shall be connected to the high high-level float, as described in Section 5.7, Multitrode by (Flygt).

22. Elapsed-Time Meters

    a) An elapsed-time meter shall be furnished for each pump.

    b) Elapsed-time meters shall have an increment of 1/100 hour.

    c) Elapsed-time meters shall have both a field-resettable display and a non-resettable display. As an alternative, both a resettable meter and a non-resettable meter shall be provided for each pump.

H. STANDBY POWER

1. Standby power shall be provided for each pumping station through either a weatherproof receptacle capable of connecting to a portable generator or a permanent on-site generator.

2. A permanent on-site standby power system shall be required at all permanent sewage pumping stations and any other station where required by the OEPA or the City of Sidney (see Appendix A).

3. Each generator shall be sized to supply emergency backup power capable of starting and operating a sufficient number of pumps to pump the maximum design flow for the station, as well as operating all other electrical components.

4. Provisions for sequential pump starting shall be made to minimize generator size and prevent overloading.

5. The backup power supply unit shall be a modular, self-contained package, conforming to NEC and local electric codes, as well as to any and all EPA and OSHA regulations.

6. The power plant driving the generator, whether permanent or portable, shall be diesel. An automatic transfer switch and auto-exercise capabilities shall be furnished with each unit.

7. Each location with a permanent generator shall be equipped with a fuel tank capable of supplying fuel sufficient for a minimum of 12 hours of generator operation at full load. The fuel tank shall be self-contained and double-walled.

8. Each permanent generator shall be mounted on a raised concrete pad in a weatherproof enclosure and shall have removable panels or housing to allow access to the engine, generator, or controls. Permanent generators shall be located so as to be accessible by a truck for maintenance purposes.

9. Other required equipment shall include an electric unit heater, ventilation system, automatic sump pump (which shall discharge into the wet well), and a sound-attenuating treatment to reduce sound levels to no more than 85 dbA at 50 feet from the enclosure. If residences are located with 100 feet of the enclosure, sound attenuation shall reduce sound levels to no more than 72 dbA at 50 feet from the enclosure.

10. Auxiliary contacts shall be furnished and installed to interface with the telemetry monitoring system for monitoring purposes.

11. If no permanent generator is provided, an auxiliary receptacle and manual transfer switch suitable for connecting to the City's portable generator shall be provided. The transfer switch shall be a NEMA 4X Enclosure 3-pole (240 or 480 volts depending on the voltage decision), double throw (center position off), stainless steel, externally-mounted. The transfer switch shall be of a

Cutler/Hammer make. The receptacles has to be a Killark make and will have to adapt to the City's equipment.

I. TELEMETRY MONITORING SYSTEM

To be installed per current City requirements and standards

J. FLOWMETERING

1. All permanent pumping stations, as well as other pumping stations specifically identified by the City, shall be provided with a flowmetering device for monitoring the discharge from each station. Station discharge piping shall be configured with a straight run of pipe with no valves upstream of the flowmeter equal in length to at least 10 pipe diameters and downstream of the flowmeter equal in length to at least 2 pipe diameters or as otherwise recommended by the flowmeter manufacturer, to provide an acceptable flow pattern through the flowmeter.

2. All flowmeters shall be calibrated at the factory prior to shipment to the site. The Contractor shall be responsible for the complete installation.

3. All new pumping station flowmeters shall be magnetic flowmeters and shall include the transmitter, the remote-mounted flow tube, and the vendor-supplied shielded cable between the two elements.

4. Magnetic Flowmeter Flow Element

   The flow element of the magnetic flowmeter shall conform to the following specifications.

   a) Pulsed DC electromagnetic induction-type, providing a signal which is linear in relation to the liquid flow rate. **NOTE: AC-type meters may be required if conductivity is below 5 microsiemens/centimeter.**

   b) Functional/performance specifications shall be as follows:

      1. Power requirements shall be matched to the flow transmitter/converter.

      2) Accuracy shall be 1%± of rate (including the transmitter/converter).

      3) The flowmeter shall be suitable for operations in process liquid temperatures up to 70° C and an ambient temperature of 65° C.

      4) RFI protection shall be provided.

5) The flowmeter shall be capable of operations under pressures of 240 psi, if 150-pound flanges are used and 700 psi, if 300-pound flanges are used.

6) The flowmeter shall be capable of running under no-flow conditions without damage to any component.

c) Physical specifications shall be as follows:

1) The metering tube of the flowmeter shall be carbon steel, unless otherwise indicated.

2) Flowmeter flanges shall be ANSI 150-pound carbon steel, unless otherwise indicated.

3) The liner shall be polyurethane or fusion-bonded epoxy, unless otherwise approved by the City.

4) Electrodes shall be 316 stainless steel, bullet-nosed or elliptical self-cleaning type, unless otherwise indicated.

5) Flowmeters shall be housed in below-grade vaults and shall be designed to withstand accidental submergence in 30 feet of water for 24 hours. Where hazardous areas are indicated on the Contract Drawings, flowmeters shall be rated for conditions in those areas.

6) All external surfaces of the flowmeters shall be painted with a chemical- and corrosion-resistant epoxy finish.

d) Accessories/options required:

1) All flowmeters shall be factory-calibrated. A copy of the calibration report shall be included in the operations and maintenance manual.

2) Flowmeters shall be grounded according to manufacturer's recommendation. All accessories, such as a ground ring, ground wires, gaskets, etc., shall be provided as required or as otherwise specified. All materials shall be suitable for the liquid being measured.

e) The flowmeters shall be a Foxboro 8000 Series, Fischer and Porter, or Rosemount magnetic flowmeter.

5. Magnetic Flowmeter Transmitter/Converter

a) The flow transmitter/converter shall be supplied by the manufacturer of the flow element.

b) Functional/performance specifications shall be as follows:

1) Power requirements shall be 120-volt AC, 10%±.
2) Accuracy shall be as defined for the flow element.
3) The operating temperature range shall be -25° C to 65° C.
4) The output shall be isolated 4-20 ma. DC into 0 to 1000 ohms.

c) The flowmeter transmitter/converter shall be housed in a NEMA 4X-rated wall mount and enclosure.

d) Accessories/options required:

1) A signal cable shall be provided between the flow element and the signal converter.

2) A local indicator shall be provided with an engineering scale to indicate actual flow rate and total flow.

3) A second flow rate indicator and non-resettable totalizer shall be provided on the enclosure RTU subpanel if the transmitter is not located in the enclosure. This unit shall be a Newport P6000 ratemeter/totalizer.

6. Chart Recorder

a) A circular paper chart recorder shall be provided for each pumping station that has a flowmeter. Recorder shall have a rotation time (recording time per chart) of at least 7 days.

b) Chart recorder shall be Eurotherm Chessel Model 392 or Foxboro 740.

c) A one-year supply of charts shall be provided.

K. PERIMETER FENCE

1. The lift station area shall be enclosed with industrial-grade chain-link fence. This fence shall be 9-gauge chain link, with 3-inch end posts and 2-inch line posts. A 1⅝-inch top rail shall be placed on the fence. The end posts, line posts,

and top rail shall be structural galvanized steel with a rating of SS20. The fence shall be 6-feet high and shall be topped with three strands of barbed wire facing outward.

2. Access through the perimeter fence shall be by means of a lockable sliding gate with a working length of 16 feet. In the event that the site layout makes a sliding gate impractical, dual-leaf swinging gates (8 feet each) may be acceptable. Either gate shall be constructed with SS20 structural galvanized steel for the outside frame (2½ inches for sliding gate or 2 inches for dual-leaf swinging gates) and SS20 structural galvanized steel 1⅝-inch filler supports. The frame shall be covered in 9-gauge chain link. The gate shall be capable of being padlocked to prevent unauthorized access to the station.

3. A personnel access gate shall also be installed in the fence in addition to the sliding gate. This gate shall be located on the perimeter fence as appropriate for convenient access to the station. This personnel access gate shall be capable of being padlocked to prevent unauthorized access to the station. The gate shall be constructed of SS20 structural galvanized steel tubing and 9-gauge chain link. The frame shall be 2-inch tubing and with a 1⅝-inch filler support.

4. The perimeter fence shall be constructed no closer than 10 feet from the wet well, valve pit, or any building, or 4 feet from the generator pad, control panel pad, or telemetry monitoring system pole. Gate placement shall be such that there is adequate truck access to the wet well, valve chamber, and generator, or, if a portable generator is used, to a plug and transfer switch. There shall be sufficient room within the fence to permit later installation of a generator (if one is not initially installed) while still meeting the above requirements.

L. FINAL GRADING AND FINISH WORK

1. Initial backfill for the lift station structure shall be non-compacting, washed pea gravel, extending to 5 feet above the bottom of the wet well. From that point to a point 8- to 10- inches below final grade, backfill shall consist of compacted fill dirt excavated from the station site, unless otherwise directed by the City. No rock or unstable backfill will be accepted. The Contractor shall ensure that compaction is sufficient to prevent any subsidence. All ground shall be stable and Contractor is responsible for repairing all subsidence and associated damage for 18 months from acceptance of the pumping station by the City.

2. Any access driveway longer than 120 feet should be constructed with a turnaround at the lift station allowing a minimum 50-foot turning radius for a truck 8-foot 5-inches wide with an overall length of 33 feet 6 inches.

3. Access driveways and turnarounds shall be black-topped. Base for black-topping shall consist of one 6-inch course meeting requirements of O.D.O.T.

Item 304. The surface shall consist of two l½-inch courses of asphalt concrete meeting requirements of O.D.O.T. Item 404.

4. A concreted parking area shall be provided for trucks. This area shall be located inside the perimeter fence if site considerations allow; otherwise, it shall be located outside the perimeter fence as near as possible to the sliding gate. This area shall be a minimum of 8 inches of 4,500 psi concrete with steel mesh reinforcing. A 4-inch-thick concrete slab shall be poured under the control panel. This slab shall have at least four times the horizontal surface area of the control panel to help prevent settlement. A minimum 4-inch-thick gravel base of O.D.O.T. Item 304 shall be provided under all concrete.

5. Six inches of O.D.O.T. Item 304 gravel shall be provided around all major lift station items (i.e., wet well, valve chamber, generator pad, etc.) and over all non-concreted areas within the perimeter fence. A solid layer of visquine plastic shall be placed under the gravel to prevent vegetative growth.

6. Pavement subgrades shall be compacted in accordance with Section 3.3, D, 1) of these specifications.

7. Finish grading shall provide positive drainage away from the wet well and valve pit top slabs and control panel. The tops of all structures should be either designed for H-20 loading or raised 6- to 12-inches above surrounding grade to prevent vehicles from driving onto them.

8. All unpaved areas around the lift station shall be finish-graded and planted with grass seed, to meet O.D.O.T. Item 659 requirements. Bushes and trees shall be planted in accordance with the surrounding landscaping and anticipated land use. In general, the site shall be left in an aesthetically-pleasing manner.

9. All pumping stations shall be supplied with a ¾-inch hose bib/yard hydrant. The hydrant will be frostless-type and will be fitted with a backflow preventer or vacuum breaker. Water service piping shall be Type K copper and shall be sized for a maximum pressure drop of 25 pounds per square inch from the water main to the pump station with the hydrant full-open.

M. TEMPORARY PUMPING STATIONS

In general, ALL pumping stations shall be considered to be permanent unless a project exists on the City of Sidney's 5-year Capital Improvements Plan that would eliminate the pumping station or the Developer has specific plans for eliminating the pumping station within approximately 5 years. However, each pumping station

will be reviewed at the inception of design by the City of Sidney to determine whether the pumping station will be considered "permanent" or "temporary" for design purposes. The Utilities Director shall make the final determination.

The criteria to be considered by the Utilities Director will include: 1) capacity of the lift station, 2) complexity of operation, 3) overflow impact upon customers, 4) overflow impact upon the environment, 5) location and ease of entry/exit for emergency equipment such as sludge trucks, etc., 6) proximity to the nearest gravity sewer and likelihood of a future sewer extension to eliminate the lift station, and 7) other factors unique to a given lift station site.

If a pumping station is to be "temporary" (as determined by the Utilities Director), certain requirements may be modified or omitted at the discretion of the Utilities Director. An outline of what these modifications and omissions will generally be is provided below.

1. The City will not require the lift station to be sized for the total upstream watershed. Instead, the lift station shall be sized for all existing and planned development (including all preliminary plans) within the watershed, regardless, of whether or not all such development is associated directly with the lift station. This means that the lift station shall have the capacity to both eliminate any existing upstream lift stations and serve development in the watershed being planned by others. Also, the requirement of 1 hour emergency storage at twice the ultimate average flow will remain.

2. A permanent on-site generator and automatic transfer switch will not be required. Instead, a manual transfer switch and auxiliary receptacle shall be provided as described in Section H, Standby Power, 11. There shall be sufficient room within the perimeter fence to park a portable generator or install an on-site generator at a later time (see Section K, Perimeter Fence, 4). Also, if the generator required to operate the lift station would be too large to pull on a trailer behind a pickup truck, a permanent on-site generator will be required.

3. The telemetry monitoring system described in Section I Telemetry Monitoring System will not be required. Instead, a Sensaphone 4100 Advanced Industrial Monitoring System (dialer) manufactured by Phonetics, Inc., shall be provided. Inputs shall be as follows:

    a) Pump fail for all pumps
    b) High-water level
    c) Unauthorized access
    d) Power failure
    e) Generator run (if provided)

4. No magnetic flowmeter and no flowmetering vault will be required. The pump hour meters will be used to estimate flow rates.

   The Utilities Director will assess each "temporary" lift station individually, based on the criteria listed above, to determine the acceptability of each modification and omission. Therefore, it is possible that a "temporary" lift station may be required to meet some or all of the "permanent" standards. The Utilities Director shall make the final decision.

   All other requirements listed within the Sewage Pumping Station Requirements shall apply universally to all lift stations, regardless of their status as "permanent" or "temporary."

900.27 Forcemains

A. VELOCITY AND DIAMETER

At design pumping rates, a cleansing velocity of at least 2 feet per second should be maintained. The minimum forcemain diameter for raw wastewater shall be 4 inches.

B. AIR AND VACUUM RELIEF VALVE

An air relief valve shall be placed at high points in the forcemain to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on forcemains. The forcemain configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Forcemains shall be installed to keep high points and low points to a minimum.

C. TERMINATION

Forcemains should enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole.

D. PIPE AND DESIGN PRESSURE

Pipe and joints shall be equal to water main strength material suitable for design conditions. The forcemain, reaction blocking, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater pump stations.

E. DESIGN FRICTION LOSSES

Friction losses through forcemains shall be based on the Hazen-Williams formula or other acceptable methods. When the Hazen-Williams formula is used, the value of

"C" shall be 100 for unlined iron or steel pipe for design. For other smooth pipe materials such as PVC, lined ductile iron, etc., a higher "C" value not to exceed 120 may be allowed for design.

F. IDENTIFICATION

Where forcemains are constructed of material which might cause the forcemain to be confused with potable water mains, the forcemain shall be appropriately identified.

G. LEAKAGE TESTING

Leakage tests shall be required per the water main testing requirements as shown in the City of Sidney Construction Standards and Drawings.

100.00
General Provisions

200.00
Definitions

300.00
Roadways

600.00
Storm Drainage

800.00
Water Distribution

900.00
Sanitary Sewers